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PREHISTORY OF CA-SHA-1544, THE MIDDLE MULE POND SITE, SHASTA COUNTY, CALIFORNIA

by
K. D. Tyree and Elaine Sundahl

With Contributions by
Susan Eugster
Parry Haskins
Eric Wohlgemuth
And
Eric Ritter

Bureau of Land Management, Redding California

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Redding, California

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ACKNOWLEDGEMENTS

The majority of this report, including all descriptive portions, was written by K. D. Tyree in 1990 and revised in 1992. This manuscript was intended to be a chapter within a larger four-site report, but as that major work was never completed, the Middle Mule Pond manuscript was not published at that time. An introduction, along with some minor editing and updating, was added by Elaine Sundahl in 2002 to complete the report as presented here.

The reclamation project and test excavations at the Middle Mule Pond site (CA-SHA-1544) were funded and made possible by efforts of the Bureau of Land Management, Redding; California State University, Chico; Shasta-Trinity National Forest-Redding; and Shasta College, Redding. Dr. Eric Ritter, BLM Archaeologist, assisted in many areas, and his contributions are greatly appreciated.

Crew members in the field include:

April 1986-

The Civilian Conservation Corp (CCC) volunteers

June/July 1988-

The Outward Bound Program volunteers: Co-leaders Jim Claflin and Elisabeth Schultz; students Angela Adams, Carey Cress, Robert Hesseltine, Jose Llamas, Marie Mesa, and Tracy Roundtree

Bureau of Land Management volunteers and other volunteers: Seth Shteir, Avery King, Sandy Flint, Eric Fields, Brenda Krischen, Merla Clark, Wanda Glidden, Shirley Newell, Jean Parry, Hugh Bunten, Tony King, Kirk Tyree, Don Manuel, Chai Inthavong, and Gerard Nedich.

Many of the above volunteers also helped wash and catalogue the collection. Thanks also go to Leslie Uhr, Dottie Smith, and Kjerstie McAffee for their special assistance.

Generous hours were contributed by Elena Nilsson who provided the initial lithic analysis. The major lithic analysis was conducted by Tyree, and Sundahl classified all groundstone artifacts. The artifact illustrations were graciously drafted by Patty Cook and Avery King. Unit profiles were drawn by May Wakabayashi and the site map by BLM civil engineering technicians, Norm Myers and Gary Mullet. Greg Tyree organized graphs and deciphered obsidian hydration regression equations

Many thanks go to those individuals who prepared specialized studies for this project: Eric Ritter, geoarchaeology and sedimentology; Susan Eugster, freshwater mussel and marine shell analysis; Parry Haskin, faunal analysis; Eric Wohlgemuth, flotation analysis; Andrius Skucas, projectile point metric analysis; Thomas Origer, obsidian hydration analysis; and Richard Hughes, obsidian sourcing data.

TABLE OF CONTENTS

PAGE

Acknowledgements i
List of Figures iv
List of Tables v

INTRODUCTION 1
  Environmental Setting 2
  Ethnographic Background 2
  Archaeological Background 4
  Models of Prehistory 6

THE MIDDLE MULE POND SITE 11
  Site Description 11
  Test Excavations 12
  Geomorphological Investigations at CA-SHA-1544 13
  Features 24
  Burials 26
  Cultural Assemblage 26
  Dating Analyses 99

CONCLUSIONS 103
  Summary of Cultural Materials and Stratigraphy 103
  Dating and Component Building 103
  Adaptive Strategies 110
  The Research Potential of the Middle Mule Pond Site 113

REFERENCES 115

APPENDICES

A. Flaked Stone Technological Attributes, Lithic Terminology, and Definitions
B. Debitage Attribute Coding
C. Attributes and Metric Statistics for Cores
D. Attributes and Metric Statistics for Edge-Modified Pieces
E. Attributes and Metric Statistics for Bifaces
F. Attributes and Metric Statistics for Projectile Points

LIST OF FIGURES

FIGURE PAGE

1. The Location of CA-SHA-1544 .... facing page 1
2. Contour Map of CA-SHA-1544 10
3. Stratigraphic Profile of Unit 3S-8W 16
4. Stratigraphic Profile of Unit 9N-1E 18
5. Stratigraphic Profile of Unit 9N-14W 19
6. Feature 3 24
7. Total combined debitage by material and level 33
8. Multiple platform cores 34
9. Single platform and bipolar cores 36
10. Edge-angle measurements for edge-modified pieces 42
11. Unifaces of metavolcanic material 44
12. Unifacial scrapers 46
13. McKee Unifaces 48
14. Bifaces 50
15. Drills 56
16. Gunther Series projectile points 58
17. Side-notched projectile points 62
18. Corner-notched projectile points 64
19. Stemmed projectile points 66
20. Projectile points plotted by depth and type 68
21. Hopper mortar 70
22. Pestle 72
23. Millingstone 74
24. Manos 76
25. Chisel/wedge 78
26. Hammerstone 80
27. Anvil 82
28. Net weight 83
29. Incised stone artifacts 84
30. Bone artifacts 86
31. Shell beads 88
32. Summary of selected artifacts and site characteristics by unit and depth 102
33. Obsidian hydration age equivalents 104
34. Diagnostic projectile points plotted by type and age 106

LIST OF TABLES

TABLE PAGE

1. Summary of Excavated Units by Location, Depth and Screen Size 12
2. Sediment Analysis 14
3. Soil/Sediment Chemical Results 20
4. Flaked Stone Attributes by Raw Material 27
5. Total Debitage by Unit and Type 28
6. Identifiable Debitage Frequencies by Material and Type 30
7. Identifiable Debitage Frequencies by Type and Level 31
8. Unidentifiable Debitage by Level and Material 32
9. Core Type by Material 37
10. Core type by Provenience 38
11. Edge-Modified Pieces by Material 40
12. Edge-Modified Pieces by Retouch Location and Shape 41
13. Selected Uniface Attributes 47
14. Selected Scraper and McKee Uniface Attributes 49
15. Selected Biface Attributes 52-53
16. Bifaces by type and Raw Material 54
17. Selected Drill Attributes 56
18. Frequencies of Projectile Point Types 57
19. Summary Metrics for Gunther Series Projectile Points 59
20. Gunther Series by Stem type 60
21. Summary Metrics for Side-Notched Projectile Points 63
22. Summary Metrics for Corner-Notched Projectile Points 65
23. Summary Metrics for Narrow-Stemmed Points 67
24. Groundstone Artifacts by Level 71
25. Proveniences and Dimensions of Pestles 73
26. Proveniences and Dimensions of Millingstones 75
27. Proveniences and Dimensions of Manos 77
28. Provenienced Mano Associations 78
29. Proveniences and Dimensions of Chisels/Wedges 79
30. Proveniences and Dimensions of Hammerstones 81
31. Proveniences and Dimensions of Anvils 81
32. Proveniences and Dimensions of Bone Artifacts 87
33. Proveniences of Marine Shell Artifacts 89
34. Faunal Remains by Taxon 90
35. Elements Identified as *Homo sapiens sapiens* 93
36. Summary of Statistics for Freshwater Mussel 94
37. Results of Floral Analyses at CA-SHA-1544 96
38. Fire-Affected Rock by Unit and Level 98
39. Results of Radiocarbon Analyses 99
40. Obsidian Hydration and Sourcing Data 100
41. Projectile Point Types by Mean Depths in CA-SHA-1544 105

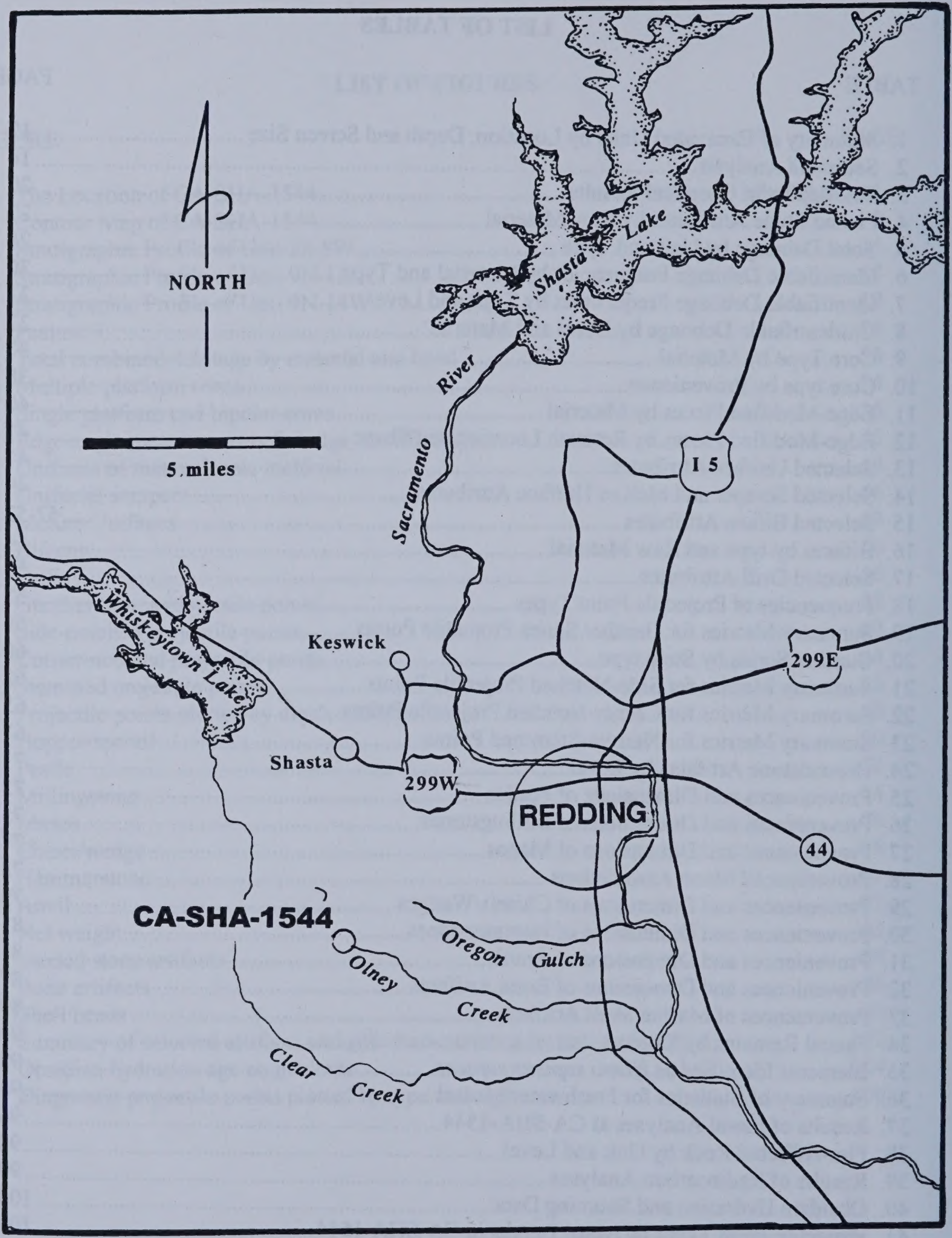

NORTH
5 miles
Shasta Lake
Sacramento River
I 5
Whiskeytown Lake
Keswick
299E
Shasta
299W
REDDING
44
CA-SHA-1544
Oregon Gulch
Olney Creek
Clear Creek

Figure 1. The location of CA-SHA-1544.

PREHISTORY OF CA-SHA-1544, THE MIDDLE MULE POND SITE, SHASTA COUNTY, CALIFORNIA

INTRODUCTION

The deceptively named Middle Mule Pond Site - neither pond nor mules are natural to the area - lies in a foothill environment west of Redding, California, at the northern end of the Sacramento Valley (Figure 1). This foothill area is rich in prehistoric sites and a fair amount of archaeological research has been conducted in the past few years, much of it sponsored by the Bureau of Land Management (BLM). These investigations have shown that many of the middens have a history measured in thousands of years. The Middle Mule Pond Site is one such site.

BLM manages 1250 acres in the Swasey area, bounded by Swasey Drive on the east, the Whiskeytown National Recreation Area on the north and west, and the Middle Creek Estates on the south (Ritter 2001). As this easily accessible area is open to recreation and other public uses, it is heavily used and is subject to damage from looting, off-road vehicles, livestock grazing, woodcutting, and natural erosion. Noting these concerns, BLM in 1985 began an extended project of documenting, testing, and designing protection measures for archaeological sites in this area, now designated the "Swasey Drive Area of Critical Environmental Concern."

Ten prehistoric and ten historic sites have been recorded within the area, and more are known (Ritter 2001). Because of extensive looting, the Middle Mule Pond Site was one of the first to be considered. There is evidence of historic placer mining within the creek and intersecting drainages, including tailings and segments of small ditches. The site takes its name from the small dam constructed about 40 years ago by the National Guard in the creek below the midden, presumably named for it's proximity to the gold rush settlements of Middletown and Muletown. It was estimated in 1986 that approximately 25% of the Middle Mule Pond Site had been damaged by mining, construction of the earthen dam and pond, road grading, and looting.

Measures to protect the site began in late 1985 and early 1986 with an assessment of site damage, the preparation of a detailed map of the site, and development of an activity plan which included 1) fencing a portion of the site to prevent vehicular access; 2) completion of restoration of the site by backfilling vandal holes and reseeding the exposed ground surface with grass; 3) the installation of archaeological protection signs; and 4) the initiation an archaeological testing program. Ed Grant, Co-Chairperson of the Wintu Cultural and Educational Council, was consulted about the project and agreed with its goals and plan of operation (Ritter 1986).

Excavations were conducted in 1988 under the direction of Dr. Eric Ritter and the senior author, assisted by BLM personnel, students of the Outward Bound Program, and other volunteers. Some 12.7 cubic meters of midden were examined through the excavations of ten one-meter square units. Objectives of the testing project were to determine the integrity and level of complexity of the site. The second chapter of this report details the results.

ENVIRONMENTAL SETTING

The Middle Mule Pond Site is located at an elevation of 970 feet (296 meters) above sea level in gentle foothill terrain near the contact of the Central Valley geomorphic province to the east and the Klamath Mountains province to the west. The rolling hills and low mountains are moderately incised by numerous intermittent and seasonal streams of the upper Olney Creek system, creating a varied topography. The site is situated on a relict cut terrace of Olney Creek, a tributary to the Sacramento River that lies seven miles to the east. The upper portion of Olney Creek is mapped as a seasonal creek, but there is information indicating that prior to the incursion of heavy brush in the 20th century it flowed year-round (Ritter 2001).

Geologically the site is situated near the edge of a Mesozoic-aged granitic intrusion (Strand 1962), and the Auberry sandy loams underlying the midden are derived from weathered granitic rock (Klaseen and Ellison 1974: 13; Map Sheet 73). Annual precipitation averages between 30 and 40 inches. Average air temperature is 64 degrees Fahrenheit but varies widely with summer temperatures commonly over 100 degrees and winter lows often below freezing.

Vegetation in the vicinity consists of a mosaic of riparian, woodland, and chaparral communities. The woodland community contains a predominance of live oak, blue oak and black oak, gray pine and poison oak. This is intermixed with a chaparral of white-leaf manzanita and *Ceanothus* and with grassland. The riparian vegetation consists of *Salix* sp., willow, coffeeberry, and wild grape.

Animals common to the area include black-tailed deer, bears, mountain lions, coyotes, gray foxes, brush rabbits, raccoons, spotted skunks, squirrels, snakes, and lizards. Birds include quail, turkey vultures, and scrub jays. The lower course of Olney Creek within the Valley proper has habitat and perennial water used by aquatic species, including salmon and fresh water turtles. Upper Olney Creek supports rainbow trout during periods of heavy flows, and suckers, squawfish, salmon and fresh-water mussels were probably present during prehistoric times.

ETHNOGRAPHIC BACKGROUND

Probably because of early Euro-American intrusions into these western foothills during the gold mining era, there is little recorded ethnographic information specific to the area. At historic contact Olney Creek lay within the territory attributed to the Wintu, who occupied portions of the Sacramento River, the upper Trinity River, and the lower McCloud and Pit rivers. The Wintu, who were grouped together based on language rather than political organization, were subdivided into eight geographic sub-areas. The three closest to Olney Creek include *elpom* or Keswick subarea, which extended along the Sacramento River from the approximate location of Shasta Dam to the Redding area; the *daunom* or Bald Hills located in the foothills south of Redding; and the *klabalpom* or French Gulch subarea which lay on the upper Clear Creek drainage north and west of the Keswick subarea (DuBois 1935:6-8). Since more than 100 years elapsed between the first Euro-American entry into Wintu territory and the systematic collection of ethnographic information, it is likely that all of these groups are largely the product of the historic period and that prehistoric groups were defined on the basis of drainages such as segments of the Sacramento

River, Clear Creek and Cottonwood Creek. It is not clear if the Wintu living along Olney Creek were associated with one of these groups, or were equally distinct from all other sub-area groupings.

The Wintu social and political life was organized around the village or small group of closely spaced villages, headed by a chief. Theoretically the chief's position was hereditary from father to eldest son, but this only applied if the son was possessed of the talent and inclination to serve as chief and was approved by the village. Each loosely related village group recognized an unofficial territory in which they fished, hunted, and gathered resources. Villages were usually located on flats adjoining streams or rivers. Houses were circular in plan, three to four meters in diameter, constructed over shallow depressions. The conically-shaped houses were constructed of bark on a framework of four main poles lashed to many other small poles. The floor was covered with evergreen boughs and contained a fireplace. Earth was banked up around the outside. A village might contain as few as three or four houses or as many as 30 to 40, each housing a biologic family of three to seven people. Larger villages also featured an earth-covered lodge used for shaman's dancing, for sweating, and as a place for men to assemble and exchange gossip (DuBois 1935:28, 122; LaPena 1978:325; Guilford-Kardell and Dotta 1981).

The Wintu economic pattern was one of hunting and gathering. As one early Redding resident observed:

> No fish or crustacean of the river, no reptile, no animal or bird, no tree or plant but has a name; and every child is taught these names and given the knowledge of what can be used as food and what would be injurious (Redding 1971:342-343).

DuBois presents the Wintu economic pattern as one in which people moved seasonally from their river-terrace villages to the hills (1935:28). Livingston Stone, an earlier observer who established a fish hatchery on the McCloud River in 1872, describes the Wintu as depending primarily on salmon and acorns, both of which they stored for use throughout the year. Hunting was of secondary importance, and may have been primarily a means of obtaining skins (Stone 1973:5). This view of the economic importance of fishing relative to hunting seems to be supported by Stephen Powers who in the early 1870s described the Wintu as ". . indifferent hunters but good fishermen, [who] kept their larders abundantly supplied with dried salmon (Powers 1976:232).

Although salmon and acorns may have been the most important dietary staples, a large variety of plants and animal resources were used for food and other needs. This includes buckeye, hazel nuts, gray pine and sugar pinenuts, manzanita and many other kinds of berries, numerous bulbs, seeds, clover, and other leafy plants. Rabbits and other small mammals, and shellfish from the river were also important resources (DuBois 1935:9-21).

Technological devises used in hunting and fishing included bows, arrows tipped with obsidian points, hide quivers most commonly made from otter or fisher skins, snares, nets, decoys, the toggle-headed harpoon tipped with bone points, weirs and "fishing houses" or structure built over the weir for spearing fish. Household implements included hopper-basket mortars, pestles, hammers, anvils, knives, bone awls, and many types of baskets (DuBois 1935:124-134).

Shamanism was one of the most important religious aspects of the Wintu culture. Both men and women could become shamans, doctors who protected their patients against the physical ills and anxieties of the natural and supernatural world, thereby fulfilling the functions of both physician and priest. Many places had religious significance, each imbued with spirits and mandatory code of behavior. Each plant and animal had feelings that must be considered. Individuals could own charmstones that brought luck for specific endeavors (DuBois 1935:82).

Emberson (2000:34). provides an excellent summary of the relationship between Wintu mythology and spiritual beliefs:

> Wintu mythology provides a wealth of data concerning the Wintu concept of the universe and the Wintu role in relationship to the earth. Myths were often used to explain natural phenomena or to prescribe behavior . . .. Through the telling of traditional narratives, Wintu people were educated about their environment, and were instilled with a moral code for interaction with the environment. The Wintu maintained an intense interest in their physical environment. They gave names to geographic features and remembered details of events that occurred at these places.

Major trade routes followed the Sacramento and Pit rivers, although the Wintu participated in trading products and materials in all directions, both within Wintu subgroups and with surrounding tribes including the Shasta, Achumawi, Yana, Chimariko, and Nomlaki. Many trade items, such as deer hides, woodpecker scalps, baskets, salt, salmon flour, and bows (DuBois 1935:24-27; Davis 1961:33-34, Maps 1 and 2), are perishable and would be unlikely to leave any trace in the archaeological record. Trade items that can be identified in archaeological deposits include clam disc beads, which originated from the central California coast, D*entalium* shells from the northwest coast, O*livella* shells found all along the California coast, magnesite beads, and obsidian. DuBois reports that some obsidian was acquired from the Shasta, but that more commonly it was obtained by individual "expeditions to Glass mountain in the north" (DuBois 1935:25). Since obsidian from what is now known as Glass Mountain in the Medicine Lake Highlands is extremely rare in Wintu cultural deposits, this term may simply refer to any source of obsidian including the Tuscan source which lay in the border area between Wintu and Yana territory, and is by far the most commonly found obsidian in Wintu cultural deposits.

ARCHAEOLOGICAL BACKGROUND

Archaeological surveys in the foothills west of Redding, largely conducted under the auspices of the National Park Service and BLM, have resulted in the location of a number of prehistoric sites, several of which have been excavated. Surveys in the valley around Redding and southward have been less systematic, largely because of early historic occupation and the multi-divided land ownership. However, a number of prehistoric sites have been recorded along the river and several have been excavated in anticipation of specific development projects.

Archaeological investigations conducted in the 1930s and 1940s, particularly in the area scheduled to be impounded by Shasta Lake, resulted in the identification and definition of the Shasta Complex, a set of artifacts, features, and other site characteristics, dating to the latest prehistoric period and believed to be associated with the ethnographic Wintu occupation (Smith and Weymouth 1952; Meighan 1955). Sites were usually located on river terraces and featured dark middens rich in obsidian and basalt flakes, mussel shell and bone fragments, pit house depressions, and an artifact assemblage consisting of Gunther series projectile points, winged drills, mortars, pestles, sandstone arrowshaft straighteners, bone awls and flakers, and shell beads and ornaments of various types.

For many years this was the only recognized prehistoric cultural stratum (e.g. Treganza 1959:26), due largely to the circumstance that only large river-terrace middens were excavated. The past 30 years, however, have seen much broader reconnaissance coverage that has located many hundreds of prehistoric sites and revealed a much more varied archaeological record. This largely resulted from the rising need by federal and state agencies to comply with new environmental regulations. It has now been demonstrated that culture history in the Shasta County area has a time depth of at least 8000 years. Cultural remains have been classified into several different taxonomic systems, but most researchers recognize three or four major prehistoric complexes or patterns in the area (e.g. Fredrickson 1974; Basgall and Hildebrandt 1989; Sundahl 1992b; Bevill and Nilsson 2001; Hildebrandt and Darcangelo 2001).

The oldest known cultural assemblage is termed the Borax Lake Pattern. It was first recognized in Lake County (Meighan 1955; Fredrickson 1974) but was found to occur in CA-SHA-475 and CA-SHA-499 on Squaw Creek (Sundahl 1992b), CA-SHA-279 near Platina (Kowta et al. 1995), and in a number of sites in the coast ranges of Trinity and Humboldt counties (Hildebrandt and Hayes 1993). Dated from about 8000 to 5000 years before present, this assemblage consists of Borax Lake widestem points, manos and millingstones. Localized differences were distinguished with the Squaw Creek aspect represented by the use of obsidian from the Grasshopper Flat/Lost Iron Wells obsidian source while the sites in the coast ranges feature the predominant use of chert (Sundahl and Henn 1995). With the exception of the sites on Squaw Creek, at Platina, and CA-TRI-1008 on the Trinity River, most sites assigned to this pattern are located on high ridgelines more than 4000 or 5000 feet in elevation. Environmental conditions are believed to have been somewhat warmer during this time period than at present with vegetation patterns correspondingly higher in elevation, thus in part explaining the distribution of these early sites.

The Borax Lake Pattern was followed by the Squaw Creek Pattern dated from 5000 to 3000 BP and characterized by large Squaw Creek contracting-stem points, McKee Unifaces, numerous cobble spalls, manos and millingstones, and the introduction of pestles and slab- and bowl mortars. Representative sites include CA-SHA-475 on Squaw Creek (Clewett and Sundahl 1983), CA-SHA-1169 at Pollard Flat on the upper Sacramento River (Basgall and Hildebrandt 1989), CA-SHA-2611/H, the Moccasin Creek site on the Sacramento River near Shasta Dam (Sundahl 1999), and CA-SHA-288 on Clear Creek near French Gulch (Chartkoff et al. 1968). Sites of this type are far more numerous than those with Borax Lake Pattern components, suggesting an increase in population. Sites attributed to the Pollard Flat Phase in the upper Sacramento River canyon, here considered to be as aspect of the Squaw Creek Pattern, contain numerous incised stone artifacts as does CA-SHA-288 in French Gulch. These artifacts are found in similar-aged sites elsewhere, but in far fewer numbers (Sundahl 1996).

It has recently been noted that although Squaw Creek contracting-stem points and McKee Unifaces are both considered characteristic of the Squaw Creek Pattern and often co-occur, several sites contain only McKee Unifaces, suggesting that the Pattern can be subdivided into early and late phases. It is unlikely that this represents functional differences since sites with McKees but lacking Squaw Creek contracting-stem point include several on the Sacramento River such as CA-SHA-2611/H at Moccasin Creek, CA-SHA-1961/H just south of Pollard Flat, and the Hedge Creek Site in Dunsmuir as well as CA-SHA-724, a high elevation ridge-top site (Sundahl and Vaughan 2001:34).

Large and middle-sized Clikapudi corner-notched and side-notched projectile points identify the Whiskeytown Pattern, roughly dated between 3000 and 1500 BP. Assemblages of this age are found in all environments, but with minor differences reflecting different activities. Riverine sites, such as CA-SHA-992, the Hartnell Site (Clewett and Sundahl 1982a), contain large quantities of basalt flakes, cores and fire-affected rock, mussel shell fragments, faunal remains from rabbit and fish, notched pebble net-weights, and relatively small numbers of projectile points. Foothill sites tend to be villages with a wide variety of artifacts and features. Examples are numerous, including those at the Whiskeytown National Recreation Area (Baker 1984, 1990; Bevill and Nilsson 2001), the Clikapudi drainage northeast of Redding (Clewett and Sundahl 1982a), and CA-SHA-1991, the Tanya Site (Sundahl 1998), located less than ¼ mile from Middle Mule Pond Site. High elevation sites predominantly consist of projectile points and obsidian debitage (e.g. Sundahl and Vaughan 2001).

Finally the Redding Aspect of the Augustine Pattern, which is virtually synonymous with the Shasta Complex, characterizes the final occupation of the Shasta County area by the Wintu. Dated in the past 1200 or 1500 years, this pattern is represented by a large number of village sites along the Sacramento River as well as numerous smaller sites on tributary drainages in foothill contexts. Typical river sites include CA-SHA-47 (Vaughan 1992), CA-SHA-169 (Treganza and Heicksen 1960), CA-SHA-222 and CA-SHA–266 (Sundahl 1982) and CA-SHA-961 near the confluence of Olney Creek with the river (Jensen 1994). Foothill sites include CA-SHA-491 (Jensen 1980), CA-SHA-782 (Farber, Ritter and Jensen 1985), CA-SHA-1481, the Fay Hill Site (Farber and Neuenschwander 1984, Farber 1987), CA-SHA-1991 (Sundahl 1998), and numerous sites in the area impounded by the waters of Whiskeytown Lake in the Whiskeytown National Recreation Area (Treganza and Heicksen 1960).

MODELS OF PREHISTORY

In addition to the sequence of cultural chronology outlined above, several models have been advanced for the area using different types of approaches including environmental change, the evolution of cultural complexity, and movements and interactions among different ethno-linguistic groups.

Environmental models for northern California are largely based on the work of James West. West's (1993) analyses of pollen from the North Coast Ranges indicate that conditions were much cooler prior to 8500 years BP with pine pollen being dominant. From 8500 to 2300-3800 BP conditions were warmer and drier with oaks expanding some 200 to 300 meters higher in elevation than at present. After that date, modern climatic conditions developed as represented by the Douglas fir-tan oak association.

West's model has been applied as explanation for the cultural evolution in the North Coast Ranges. The Borax Lake Pattern is viewed against the background of a warm climate with an upland habitat rich in resource abundance and diversity. Tool assemblages were varied, representing the exploitation of a wide variety of resources. With the cooling climates and increased effective moistures after 3800-2300 BP it was hypothesized that the cultural use of the area became increasingly specialized with the higher elevations featuring flaked stone tool assemblages associated with the exploitation of game (Hildebrandt and Hayes 1993:113-115).

A second environmental model, more detailed for the past 4000 years but based on data from a much broader area, proposes that although there have been no major changes in the California environment during this period, there have been three cooler-wetter episodes, dating 2600-2000 BP, 1100-900 BP, and 600-100 BP (Moratto, King and Woolfenden 1978). This model has been utilized to explain the expansion around 600 years ago of the Shasta Complex people from riparian areas into what are now drier foothill areas, generally unsuitable for permanent habitation (Sundahl 1992b).

The "medieval climatic anomaly" hypothesis (Jones et al. 1999) present evidence of a warm dry period between AD 800 and 1350, punctuated by two periods of extreme drought with a shorter intervening period of high rainfall in a number of localities in the western United States. Cultural changes that correlate with environmental change include increased warfare, changes in subsistence, abandonment of habitation sites, reduction in trade, and major population movements. Although this model was not applied to data from northern California, it was noted that there were massive shifts of populations in central California during this period.

A subsistence-settlement pattern based on Binford's (1980) forager-gatherer model was proposed to explain cultural differences among the three phases defined for the upper Sacramento River (Basgall and Hildebrandt 1989:432-433, 444-446). The Pollard Flat phase, dated from 5300 to 2900 BP and considered here to be an aspect of the Squaw Creek Pattern, is seen as forager-like. Little emphasis was placed on storage, and resource incongruities were resolved by moving the entire social unit from place to place where foraging opportunities were enhanced. In contrast, the subsequent Vollmers phase, dating between 3900 and 2100 BP and viewed here as an aspect of the Whiskeytown Pattern, represents a "fission-fusion" strategy in which the entire social group shared fall and winter base camps but dispersed into smaller logistically organized units that collected resources with specialized equipment. The temporal overlap between these phases, based primarily on obsidian hydration values, is explained as representing two different groups using the same sites at different times. The third phase, the Mosquito Creek phase, dating from 1900 BP to the historic period and containing some similarities to the Shasta Complex, appears to represent short-term seasonal occupation by smaller social units that continued the fission-fusion strategy.

A recent compilation of temporally diagnostic projectile points from Shasta and Tehama county sites is used to demonstrate a gradual movement of populations from mountains to riparian habitats (Hildebrandt and Darcangelo 2001:67-71, Table 24). This study reveals that Borax Lake and Squaw Creek contracting stem points (together constituting 8.6%), McKee Unifaces (14.1%), and Clikapudi notched points (60.2%) have their highest frequencies in mountainous sites while Gunther points are most commonly found in foothill (69.3%) and riparian (91.2%) settings. Note that the foothill zone in this study includes the area west of the Sacramento River to about 1000 feet in elevation and the mountain zone is everything above 1000 feet, while the riparian zone is a narrow corridor along the river at approximately 500 feet in elevation and below. These data are interpreted as representing a progressive shift in settlement from the early occupation of upland areas to a more intensive use of the Sacramento River later in time (Hildebrand and Darcangelo 2001:71). These figures would be somewhat altered by the inclusion of data from three recently excavated Redding sites located on a large flat just north of the Sacramento River (Vaughan and Sundahl 2002; Vaughan and Sundahl n.d.). Projectile points from these three sites are 88% Clikapudi series versus 12% Gunther series. By contrast, Gunther series points make up 100% of the points recovered from the nearby CA-SHA-47. These figures would not alter the overall trend, but do demonstrate the use of the low-lying river terraces during the Whiskeytown Pattern period.

An earlier geographical model was developed using different definitions of the environmental zones (Sundahl 1996). The riverine setting is defined as lying at elevations below 500 feet and within 600 feet of the river. Resources include acorns from valley oaks, large salmon runs, and freshwater mussels as well as deer and many other mammals. As the river cuts through the foothill environments, resources such as grasses, grey pine, and manzanita were also close at hand. The foothill setting lies more than 600 feet from the river and includes low elevation mountain sites up to 3500 feet in elevation. Resources were similar to those in the riverine setting, but with fewer riparian resources. Anadromous fish were often present. Oaks shift to blue oak, live oak, and above 1000 feet in elevation, black oak. Ponderosa pine is added above 1200 feet in elevation. Mountain settings lie between 3500 and 6000 feet in elevation and are generally in or adjoining coniferous forests. Major resources include deer and numerous other mammals, resident fish, and forest products such as pinenuts and berries.

Using these definitions, the Borax Lake Pattern is found in mountain and foothill environments. Mountain sites in the Sacramento drainage are poorly known, and data are most available from the Northern Coast Ranges. A comparison among high elevation sites, primarily on Pilot Ridge and Southfork Mountain, and CA-TRI-1008, a Borax Lake site located at 1300 feet in elevation on the Trinity River, revealed that the assemblages from the two areas were virtually identical with artifact types in similar proportions (Sundahl and Henn 1993:84-85). This was interpreted as representing populations that ranged widely during the year, following animal herds and the maturing of plant communities and using a similar tool kit for exploiting all environments. Except for stylistic differences, the Borax Lake foothill sites in Shasta County are very similar to those in Trinity County.

The Squaw Creek Pattern is heavily represented in foothill contexts with far lesser numbers known in high elevations or riparian contexts, both of which are represented primarily by projectile points and debitage, suggesting some differentiation of seasonal activities. The subsequent Whiskeytown Pattern is widely represented in all environments, but with increasing differentiation among tool kits. Riparian locations feature large amounts of basalt debitage, milling equipment, and notched pebble net-weights with lesser numbers of projectile points and obsidian debitage. Foothill locations are often villages with a wide variety of artifact classes.

Mountain sites most commonly contain points and obsidian debitage. The Shasta Complex is represented in riparian settings with large midden sites and a wide variety of artifact types. Similar sites are common in foothill environments, but tend to be smaller with shallow middens (Sundahl 1996). Ritter (personal communication 2002) suggests that some foothill sites may contain transitional components, perhaps representing cultural integration.

Several ethno-linguistic models associate the introduction of a specific artifact assemblage or patterns with the appearance of ancestral linguistic groups. Many investigators draw a connection between the appearance of the Borax Lake Pattern materials and the migration into the area by peoples speaking a language or languages of the Hokan linguistic stock. For instance:

> In the immediate post-Pleistocene, a specialized economy involving the intensive utilization of grass seeds developed at some point in the arid or semi-arid west . .This economic pattern had as its stigmata quantities of millingstone. . . There is a fairly precise congruence between the Hokan languages of California and the early distribution of milling stone cultures . . . (Lathrap and Troike 1988:100101).

This argument is bolstered by the distribution of wide-stem points similar to the Borax Lake type from the desert areas of Nevada and southern California northward throughout most of northern California (Justice 2002:110-112).

The introduction of the Shasta Complex into the Redding area has long been associated with the appearance of the Wintu people. Linguistic studies suggest that the Wintu expanded into their ethnographic territory some 1200 or 1300 years ago, although there is still some debate about their earlier homeland and original date of entry into California (Whistler 1977; Levy 1996). It is generally believed that prior to the arrival of the Wintu, whose language is classed with the Penutian language family, the area was occupied by a tribe or tribes affiliated with the Hokan language family such as the Shasta, Chimariko, and Yana. One hypothetical reconstruction places the Chimariko in the Redding area west of the Sacramento River at a time depth of 4000 to 2000 years ago (Moratto 1984:562). Another possible candidate is the Okwanuchu band, a subgroup of the Shasta, which during ethnographic times occupied the upper Sacramento and McCloud Rivers.

The differing distribution of obsidian by source led to the hypothesized movement of one Hokan group against another (Sundahl 1984). Early components in several foothill sites east of Redding feature a preponderance of obsidian from the Grasshopper Flat/Lost Iron Wells obsidian source located in the Medicine Lake Highlands, which during ethnographic times lay in Achumawi territory. The introduction of the Whiskeytown Pattern into these sites brought a nearly total replacement by notched points made of obsidian from the Tuscan source, located in the foothills south of the Pit River. This was interpreted as possibly representing a northward movement of the Yana, who displaced the Achumawi to the northern side of the Pit River. Since ethnographic and linguistic research cannot provide a clear solution to this problem, clues may be contributed through archaeological research.

It is within this framework of chronology, settlement-subsistence and ethno-linguistic models that the cultural materials from the Middle Mule Pond Site are considered.

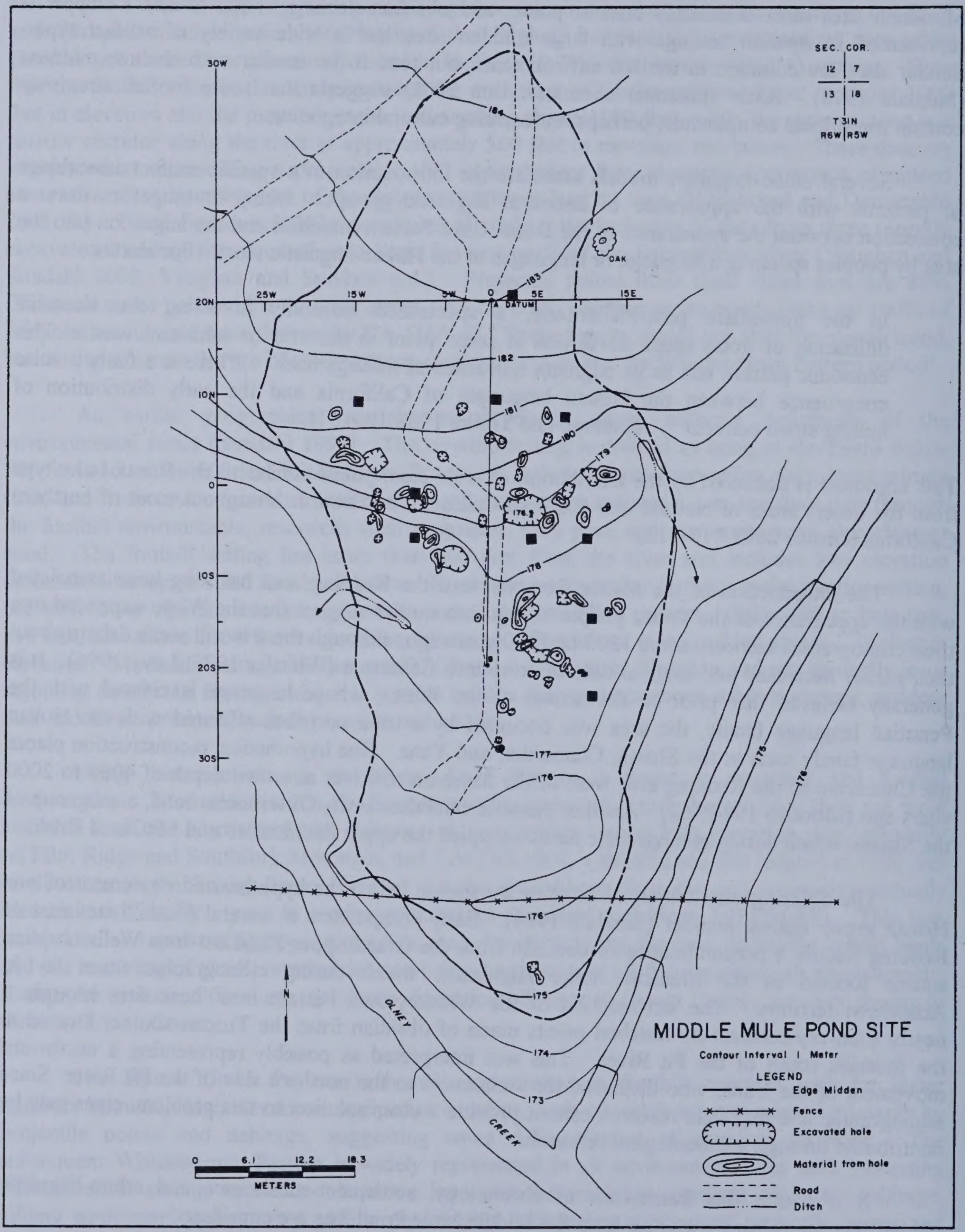

SEC. COR.
12
7
13
18
T 31N
R6W
R5W
30W
184
OAK
183
20N
25W
15W
5W
0
5E
15E
DATUM
182
10N
181
180
179
0
176.2
178
10S
20S
30S
177
176
175
176
176
175
N
OLNEY
CREEK
174
173
MIDDLE MULE POND SITE
Contour Interval 1 Meter
LEGEND
Edge Midden
Fence
Excavated hole
Material from hole
Road
Ditch
0
6.1
12.2
18.3
METERS

Figure 2. Contour map of CA-SHA-1544.

THE MIDDLE MULE POND SITE
(CA-SHA-1544)

SITE DESCRIPTION

The Middle Mule Pond Site lies on a wooded terrace on the north side of Olney Creek. The terrace gently slopes from north to south toward the creek with the cultural deposit measuring approximately 110 meters north and south by 50 meters east and west. The site was originally recorded in 1981 by D.P. Miller and Teri Klippert, re-recorded in 1986 by Eric Ritter, and assigned the trinomial CA-SHA-1544. Middle Mule Pond was listed as a "moderate-sized midden deposit possibly representing a small village" (Ritter 1986). Artifacts noted on the surface include a shaped pestle, debitage of obsidian, metavolcanic, and chert, cores, and a basalt chopper-like tool. The report also mentions numerous fire-affected rock (FAR), small bone fragments, charcoal and a "very questionable housepit" (Ritter 1986).

Subsequent to the original recording it was realized that an additional cultural deposit was located on a low terrace on the south side of Olney Creek and immediately west of the pond created about 40 years ago by the National Guard, presumably as a training exercise. This deposit, which includes both prehistoric and historic materials, was recorded as a locus of CA-SHA-1544/H and was archaeologically investigated between 1994 and 1996 by the Shasta College Field Archaeology class. It was determined that the historic component represents a late 19th century residential occupation, probably related to Chinese placer mining in Olney Creek. The shallow prehistoric component appears to an auxiliary, casually used locus of the larger midden, occupied over a long period of time as represented by diagnostic projectile points (Sundahl 1997). The report that follows describes only the large midden north of Olney Creek.

An assessment of the site's condition was completed in January 1986 (Ritter 1986). Initial field measures included backfilling potholes and screening the backdirt to recover selected cultural materials. This was accomplished in the spring of 1986 by members of the Civilian Conservation Corps (CCC) under the direction of Eric Ritter. The 672 items collected from this screening were catalogued as 295 entries in Accession 97 of the Shasta College Archaeology Lab.

A detailed contour map of the site was prepared by Bureau of Land Management personnel delineating site boundaries, modern features, contours, and areas of disturbance (Figure 2). The site was divided into four quadrants with two bisecting datum lines (Datum A: north/south; Datum B: east/west) crossing near the site center. The areas, delineated by these datum lines, were designated as: Northwest, Northeast, Southwest, and Southeast. Vandal holes were lined with visqueen so as to keep separate the disturbed and undisturbed midden. Backdirt was subsequently screened and placed in the holes. All formed artifacts and a selection of debitage, bone, and shell not removed by the vandals were collected for analysis. Professional and para-professional archaeologists assisted CCC members in the recovery (see cover photograph).

TEST EXCAVATIONS

Formal testing of the site began in June 1988 and continued for seven weeks. Originating at the 0-North-South/ 0-East-West datum point, ten one-meter square units were established (Table 1). The units were placed in areas where depositional integrity was likely and in locations which would assist in defining site boundaries (see Figure 2 for locations). The contour map assisted in avoiding vandalized areas. Units were excavated in arbitrary 10-centimeter levels following surface contours using trowels, shovels and pick mattocks depending on soil compaction. A total of 12.7 cubic meters of midden was screened; soils from three units were passed through 1/8-inch mesh and soils from the other seven units were sifted through ¼-inch mesh screens. All units were excavated to culturally sterile soil or to decomposing bedrock.

All cultural materials were recovered, collected and provenienced by unit and level. Artifacts on the surface and/or road cuts were provenienced from the 0/0 datum point. Fire-affected rock was measured, counted, weighed and discarded unless there were indications (e.g. rounding) that the item might be a tool or tool fragment. Specimens were placed in plastic bags and labeled. Additionally, selected profiles were sketched, and soil, column samples, and feature matrices were collected. Specimens were washed and cataloged. All cataloging and analyses of artifacts were technically recorded and assessed through the use of Lab Assistant (a software file/data base program by Scott Edmondson of Archaeological Software, Inc.). The assemblage is curated at the Shasta College Archaeology Laboratory under Accession #97.

Excavated units, prior to backfilling, were lined with visqueen. At the conclusion of the testing phase, efforts were made to produce a flat surface contour so as to make the site less appealing to would-be looters. A permanent datum point was established near the southern edge of the site along Datum A.

TABLE 1

Summary of Excavated Units by Location, Depth, and Screen Size

Unit Location	Maximum Depth	Screen Size
8S-8W	190	1/4
8S-11E	120	1/4
17S-12E	70	1/8
21N-3E	40	1/4
9N-14W	130	1/8
9N-1E	170	1/4
25S-12E	90	1/4
7N-8E	120	1/8
3S-8W	180	1/4
8S-5E	160	1/4

GEOMORPHOLOGICAL INVESTIGATIONS AT CA-SHA-1544

by Eric W. Ritter

Introduction

Archaeologists are fully aware of the need for interdisciplinary studies oriented toward an elucidation of past human behavior as expressed in cultural remains. However, this advocacy for interdisciplinary work is not always brought to fruition. Test excavations at the Middle Mule Pond Site (CA-SHA-1544) were undertaken with the guidance of a research design weighted toward an interdisciplinary strategy. Along this line, geoarchaeological studies of a cultural deposit have been found to be of paramount importance to archaeological work, and this study is a product of this understanding.

Midden, as at the Middle Mule Pond Site, is a reflection of cultural deposition over time, including detectible physical and chemical variations in the soils and sediments of the deposit. These measured variations can relate to intrasite activity diversity as well as chronological changes in occupation that may be associated with differing periods or cultures. Additionally, a study of the archaeological site's soils, sediments, and stratigraphy may reveal insights into past environments, site formation factors, and changes in the deposit during and following use.

Stein (1985:5) has stated that careful study of the sediments, chemical residues and sedimentation of an archaeological site is required to identify the cultural component of the site matrix. The four important factors are source, transportation mechanisms, deposition environment, and post-deposition environment. An examination of those physical and chemical properties of the soil/sediments thought meaningful for each site, based on previous regional research and an analysis of the local geomorphology and soils, potentially can lead to the identification of the nature of each of these factors as well as the natural and/or cultural agents responsible. Off-site sample studies for baseline comparisons are essential, since it is assumed the physical and chemical processes involved in the creation of a sediment are uniform in time and space. In this manner human and natural agents can be factored out in the formation analysis.

The author completed profiles of select units thought representative of the site insofar as possible considering inherent biases in the excavation sampling. These biases include constraints imposed by previous site damage, vegetation (including dense poison oak stands and oak and pine trees), plus purposive placement of units. No long trenches were excavated for observations. Column samples of soil-sediments were taken from these units at location thought least disturbed and most representative of the profile variability. Samples also were obtained within strata of certain units, from several features, and from off-site. Select samples were submitted to the University of Wisconsin-Milwaukee State Soils Laboratory for analyses (see Eidt 1984 for an explanation of the lab's testing procedures). It also should be stated that budgetary constraints limited the number of samples that could be run, especially for soil phosphate tests. Profile descriptions were aided by guides from the United States Department of Agriculture (1951, 1961) with soil colors from the Munsell soil color charts (1954).

Local Geology and Geomorphology.

The Middle Mule Pond Site Mule Pond site is situated within the Klamath Mountains geologic province on a relict cut terrace of Olney Creek. This terrace is quite restrictive in extent in the foothills cut by the creek. Ancestral Olney Creek cut a swath (probably during the Pleistocene) through the Mule Mountain Stock and adjoining Copley Greenstone leaving behind the flat terrace adjoining the perennial stream. Rounded boulders at depth suggest some residual alluvium in places, the aftermath of catastrophic erosion and deposition. An analysis of the gravels in the excavation units and off-site (both total amounts and roundness) (Table 2) indicates relatively low amounts of small gravel with a wide range of rounding (with a mean about in the middle on a scale of 1-10) (see Powers 1958). This would tend to suggest minimal alluviation and perhaps some sheetflood deposition.

TABLE 2
Sediment Analysis

Unit/Level/Stratum	Average Gravel Roundness*	%Gravel	%Sand	%Silt	%Clay	Type
9N-1E 0-10 Ia	3-4	5-10	60	20	20	SL, SCL
9N-1E 29-36 Ib	4-6	10-15	70	22	8	SL
9N-1E 70-80 Ib	6	15	54	37	9	SL
9N-1E 102-112 II	4-5	3-5	50	26	24	SCL
9N-1E 128-138 II	4-5	15-20	45	38	17	L
9N-1E 155-165 III	5-6	8	40	37	23	L
3S-8W 0-10 Ia	5-6	12-15	61	27	12	SL
3S-8W 13-21 Ib	4-5	20	60	25	15	SL
3S-8W 31-41 II	5-6	20	53	33	14	SL
3S-8W 56-64 II	4-5	30-35	53	37	10	SL
3S-8W 88-96 III	5-6	20	48	43	0	L
3S-8W 128-138 III	5-6	15-20	63	17	20	SL
3S-8W 175-185 IV	6	15	57	23	20	SCL
9N-14W Ash Feature	5-6	15	42	35	23	L
9N-14W 33-43 Ib	4-5	25-30	40	33	27	L
9N-14W 97-107 II	5	15	41	32	27	L to CL
Off-site/hill						
0-10	4-5	5	35	27	38	CL
10-20	5	10	33	33	34	CL

*after Powers (1958)   S=Sandy C=Clay L=Loam

The Mule Mountain Stock, underlying most of the site, is of probable Late Jurassic age (Hollister and Evans 1965) and is composed of quartz diorite (granitic) with aplite dikes that resemble quartzite. The Copley Greenstone, mapped less than a quarter of a mile to the east (but actually underlying a small part of the site), is composed of green, greenish-purple and purple metavolcanic/metabasalt rock. Within Olney Creek, well above the site, are small areas of the Balaklala Rhyolite, both extrusive and intrusive.

Local Soils.

The soil series mapped for the site vicinity by Klaseen and Ellison (1974:sheets 73-74) is the Auberry fine sandy loam (Utic Haploxeralfs). The authors (Klaseen and Ellison 1974:13) describe a typical profile as including an A horizon from 15 to 25 inches thick, of fine sandy loam to loam, dark grayish brown (10YR 4/2) to pale brown (10YR 6/3) or light brownish gray (10YR 6/2, moist) with a pH from medium acid to neutral. The B-horizon ranges from five to 24 inches in thickness, from very pale brown (10YR 7/3) to dark yellowish brown (10YR 4/4, moist) in color, from light clay loam to sandy clay loam to clay loam in texture, and from strongly acid to very strongly acid in reaction. Occupation probably commenced on soil similar to that described above, or at least on a younger, less developed variant.

Stratigraphy

The scattered unit profiles demonstrate a lack of uniform stratigraphy across the site, which is surprisingly deep in some areas. This variation is clearly the result of an interplay of variable human events within the site over time and far less so a result of environmental factors such as burrowing animal activity and possibly sheetflooding. Nevertheless, there are some generalities that can be applied. Three select profiles, 9N-1E, 9N-14W, and 3S-8W, generally representative of the more complex central units within the sample, are exhibited in Figures 3-5. In all, seven profiles of a single wall of a unit were accurately drawn and analyzed in the field (9N-1E, 9N-14W, 7N-8E, 3S-8W, 8S-8W, 8S-11E, and 26S-11E). These form the basis for this discussion. These profiles seem to reasonably encompass the complexity of the soil/sediment situation at the site.

From two to four strata were defined in the excavations that were not concluded until sterile deposits were reached. Overall, the top two strata include the principal occupation deposit with the bottom strata, where present, a mixture of the original solum and cultural residues. In some units, the second stratum (II) represents a transitional zone between cultural deposits and the original soil. Exceptions to this generality are discussed below.

The uppermost stratum across the site is divided into two sub-strata, Ia and Ib. In most units Stratum I is the main zone of cultural deposition (most refuse) and ranges from surface to between 85 and 100cm in depth. However, two deep units in a mounded central area of the site differ. Here stratification varies due to cultural factors including human interment in the vicinity of Unit 8S-8W, and intense burning, possibly from the razing of a bark and earth structure. Use of large stone ovens also may be involved, including the aftermath of their dismantling and cleanout.

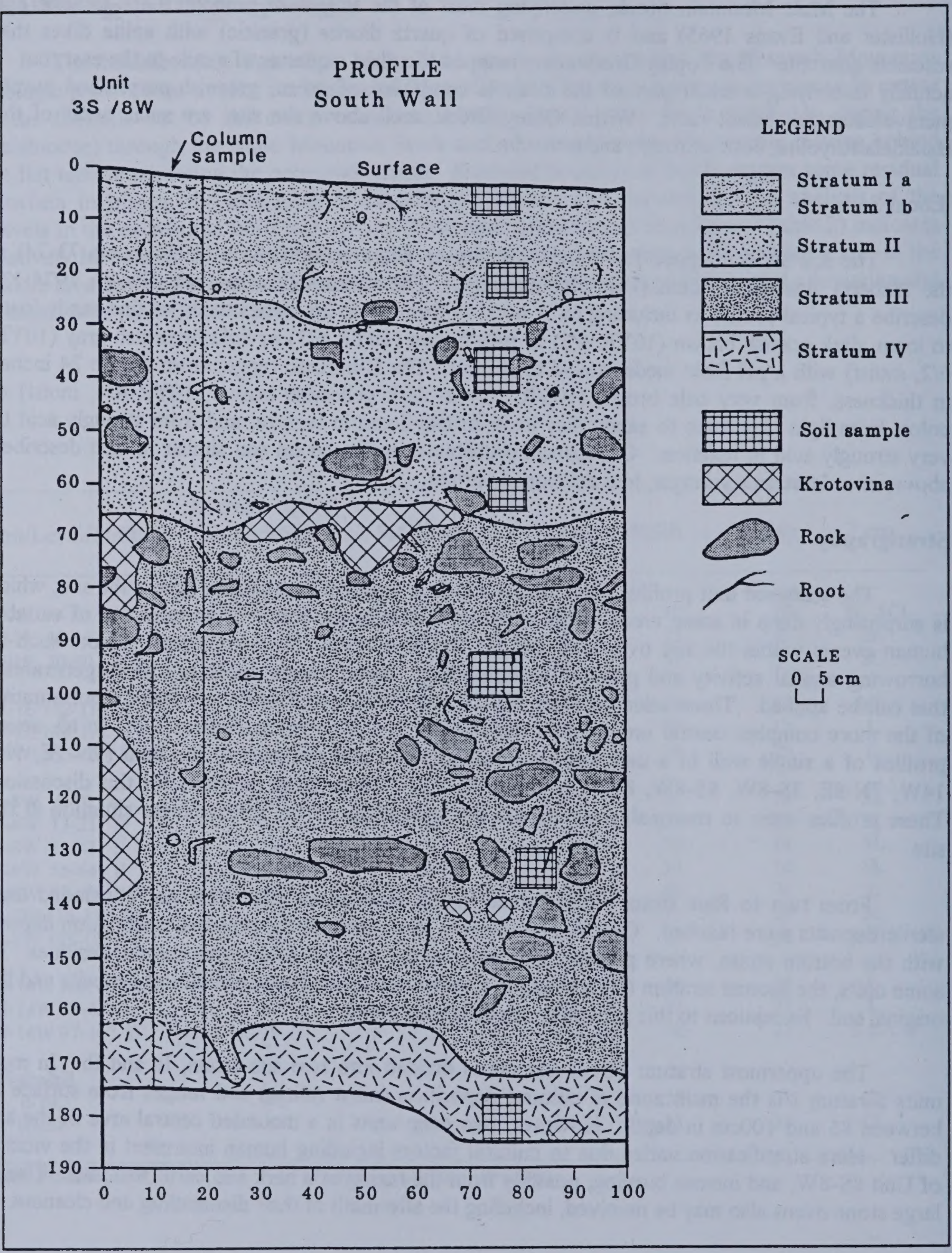

Unit
3S /8W
PROFILE
South Wall
Column sample
Surface
LEGEND
Stratum I a
Stratum I b
Stratum II
Stratum III
Stratum IV
Soil sample
Krotovina
Rock
Root
SCALE
0 5 cm
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
0
10
20
30
40
50
60
70
80
90
100

Figure 3. Stratigraphic profile of Unit 3S-8W.

Throughout the site there is a soft to loose sandy loam to sandy clay loam surface zone including a grass mat with abundant rootlets and decaying vegetation. Stratum Ia is a dark brown (10YR 3/3, dry) to dark gray brown (10YR 4/2, dry) layer, 5-10cm thick, with weak granular structure and a wavy clear to abrupt boundary with underlying Stratum Ib.

Stratum Ib is generally similar to Stratum Ia in color, structure and consistency and is quite stony due to the high amounts of fire-affected cobbles. Medium sized and smaller roots are common. Stratum II and III of the deep units 3S-8W and 8S-8W generally resemble Stratum Ib of the other units. This suggests a layer of overburden in the range of 25cm, as mentioned above, possibly from the collapse of a partially earth-covered structure or structures, soil-sediment translocation due to interment, or some other cause. The boundary between Stratum Ia and II is wavy and varies from gradual to clear except in the two deep units listed above where it is abrupt, possibly an indication of a single event or a short term (several years to decades) sequence of events.

Stratum II, except in units 3S-8W, becomes dark yellowish brown (10YR 4/4), yellowish born (10YR 5/6), or brownish yellow (10YR 6/6) in color, probably an indication of a transitional zone between a midden deposition and the original "A" horizon of the pre-occupation soil. Evidence of rodent burrowing is apparent throughout the deposit by krotovina of various ages including those relatively new to those quite obscure. Stratum II is loam to clay-loam in texture, strong granular in structure, slightly hard to hard, with fewer rocks and roots. The boundary with underlying Stratum III is quire variable, from clear and wavy to gradual and broken (due to bioturbation). In units 3S-8W and 8S-W, Stratum II is dark colored, stony, ashy, soft, granular and well-defined as a stratigraphic unit. However, it is shallow in Unit 8S-8W (25-150cm). These two units themselves are obviously not congruous and it would appear that Stratum III in 3S-8W may be the same as Stratum II in Unit 8S-8W. Both these strata in turn are roughly correlative with Stratum Ib in the other units. It is interesting to note (Table2) that gravels are higher in Stratum II of Unit 3S-8W than anywhere else sampled in the site. Once again, variation in local short-lived cultural events (as discussed above) probably accounts for the differences between the two nearby units of 3S-8W and 8S-8W.

Stratum III, in units other than the two described immediately above (and where present in 9N-1E, 9N-14E and 8S-11E), is a yellowish brown (10YR 5/6) to strong brown (7.5YR 5/8), hard loam to clay loam with a strong granular structure. This stratum is virtually sterile except for artifacts and ecofacts introduced by bioturbation. It reaches depths from 110 to 150cm. This stratum and Stratum IV of similar characteristics in units 3S-8W and 8S-8W, where depths to about two meters were approached, are clearly remnants of the earlier "A" and "B" horizons of an earlier soil as described in the previous section. This is also apparent from the physical analyses of the off-site sample (see Table 2).

pH

The pH within the site varies from neutral to mildly alkaline, while the off-site samples are in the slightly acid range. Determinations are presented in Table 3. It is well known that burning, baking, trash disposal, etc. contribute bases (carbonates) to a deposit (Cornwall 1958:193; Setzer 1947:57) thereby raising the values in comparison to areas of little or no human activity. This is

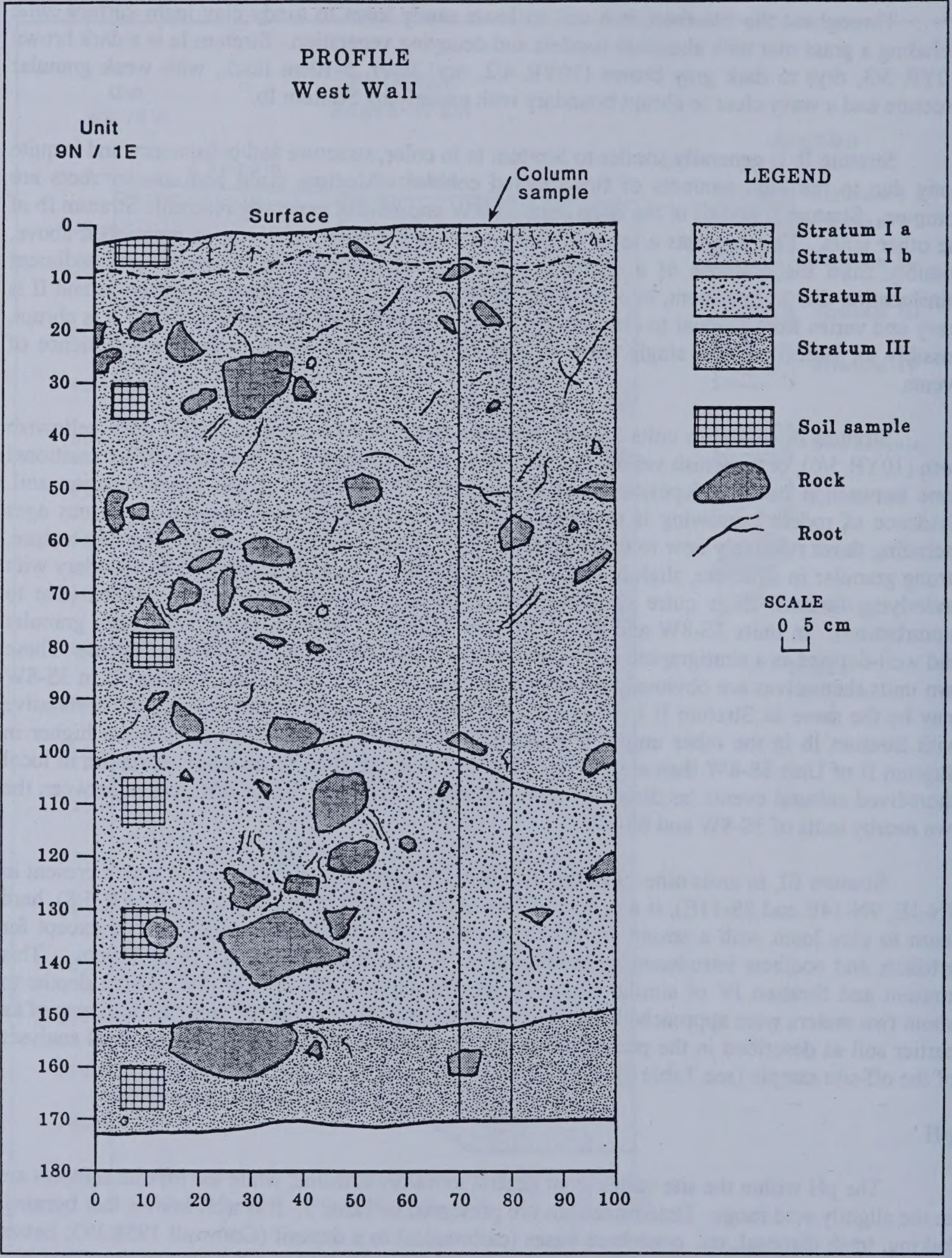

PROFILE
West Wall
Unit
9N / 1E
Column sample
Surface
LEGEND
Stratum I a
Stratum I b
Stratum II
Stratum III
Soil sample
Rock
Root
SCALE
0 5 cm
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
0
10
20
30
40
50
60
70
80
90
100

Figure 4. Stratifraphic profile of Uniit 9N-1E.

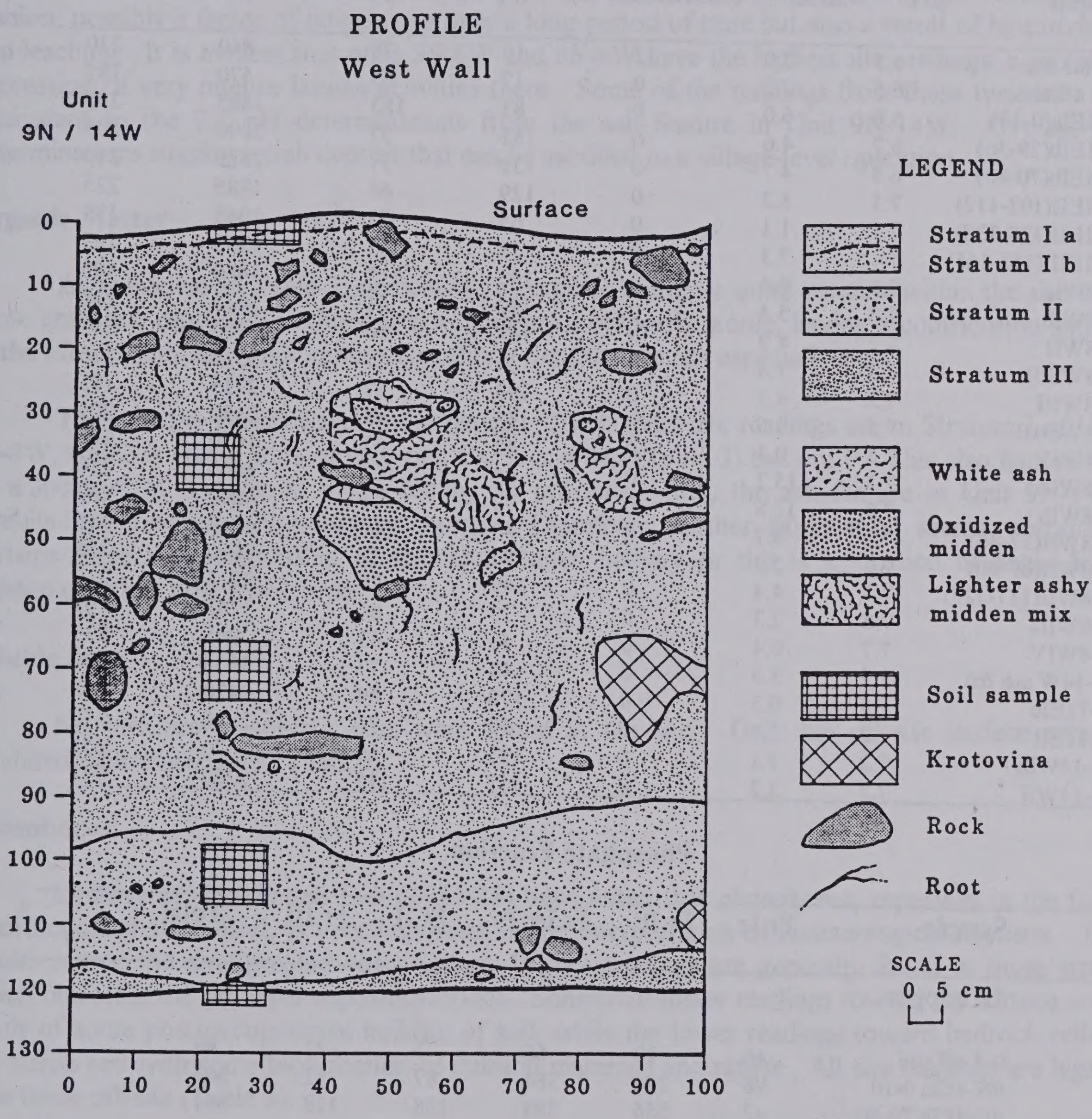

PROFILE
West Wall
Unit
9N / 14W
Surface
LEGEND
Stratum I a
Stratum I b
Stratum II
Stratum III
White ash
Oxidized midden
Lighter ashy midden mix
Soil sample
Krotovina
Rock
Root
SCALE
0 5 cm
0
10
20
30
40
50
60
70
80
90
100
110
120
130
0
10
20
30
40
50
60
70
80
90
100

Figure 5. Stratigraphic profile of Unit 9N-14W.

TABLE 3
Soil/Sediment Chemical Test Results

Sample	pH	% of Organic Matter	Soluble Salts (MHOSx10-5)	Available: P(ppm)	K(ppm)	Ca(ppm)	Mg(ppm)
0-5 off site	6.3	5.0	12	19	78	840	210
5-10 off site	6.5	2.2	0	17	65	470	185
9N-1EIa(0-10)	6.6	6.0	0	83	183	1865	285
9N-1EIb(29-36)	6.7	4.6	0	151	57	2090	205
9N-1EIb(70-80)	6.8	4.7	0	139	59	2525	210
9N-1EII(102-112)	7.1	3.2	0	129	66	1885	225
9N-1EII(128-138)	7.1	1.1	0	65	72	1045	170
9N-1EIII(155-165)	7.1	7.3	0	58	65	1395	185
3S-8WIa	7.0	0.6	0	133	117	1480	195
3S-8WIb	7.0	5.4	0	122	61	2635	230
3S-8WII	7.2	4.9	0	107	60	3605	210
3S-8WStII	7.4	7.8	0	134	57	3510	225
3S-8WIII	7.3	4.5	0	193	77	2715	195
3S-8WStIII	7.5	4.6	0	113	73	2180	205
3S-8WIV	7.5	0.3	0	42	62	1010	180
8S-8WIa	7.3	15.2	0	64	127	1860	210
8S-8WIb	7.3	12.8	0	79	54	4800	250
8S-8WII(37-46)	7.3	8.7	0	85	49	4710	235
8S-8WII(80-90)	7.7	5.3	0	170	71	1690	205
8S-8WII(117-127)	7.7	4.4	0	149	79	2715	210
8S-8WIII	7.8	2.3	0	79	81	1785	195
8S-8WIV	7.7	0.4	0	46	63	965	230
9N-14W ash fea.	7.7	3.5	0	144	77	3335	225
8S-11EIb	7.5	6.3	0	178	60	2420	235
8S-11EII	7.2	1.4	0	53	76	2080	210
9N-14WIb	7.2	9.1	0	125	69	3670	255
9N-14WII	7.5	2.2	0	112	115	2260	235

Phosphate Fraction

Sample	Fr.Ia	Fr.Ib	Fr.Ia+Ib	Fr.II	Fr.III	Total
*P in ppm						
0-5 off site	46	20	66	1	22	89
9N-1EIa 0-10	98	286	384	87	92	563
9N-1EIb 70-80	42	556	598	168	128	894
9N-1EII 128-138	55 168	223	62	46	331	
*P in %						
0-5 off site		74	1	25		
9N-1EIa 0-10			68	15	16	
9N-1EIb 70-80			67	19	14	
9N-1EII 128-138			67	19	14	

clearly the case at the Middle Mule Pond Site. Also at CA-SHA-1544, readings generally show a slight increase from surface to subsurface, a reflection in part of downward leaching of metallic compounds.

The readings by depth do not differentiate significant stratigraphic breaks in any clear fashion, possibly a factor of intense use over a long period of time but also a result of bioturbation and leaching. It is evident that units 3S-8W and 8S-8W have the highest site readings, a probable expression of very intense human activities there. Some of the readings from these two units are equivalent to the 7.7 pH determinations from the ash feature in Unit 9N-14W. Overall, pH determinations suggest a rich deposit that can be ascribed to a village-level operation.

Organic Matter

As is evident in Table 3, percentage of organic matter is quite variable within the site with some amounts, especially in those strata thought to be nearly sterile, having a contribution similar to the off-site samples, while other rich cultural deposits are not especially high.

There is one anomaly worth discussing. The highest site readings are in Stratum I of Unit 8S-8W, which is also a zone of very rich Ca, K and Mg (Table 3) but not P. This also happens to be a location of burning as evidenced by an ash lens. Still, the ash feature in Unit 9N-14W exhibits low readings (high organic burn). Therefore, another explanation seems warranted. Perhaps there is a relationship to intensive human activity or this is a location of dense litter buildup over late prehistoric times.

Soluble Salts

No measurable soluble salts were found at the site. Only the off-site surface sample exhibited measurable salts (Table 3).

Phosphorus

Limbrey (1975:72) and Eidt (1984:26) have noted that phosphorus, especially in the form of orthophosphate radical, is very important in the interpretation of archaeological deposits. The results mirror the stratigraphic observations. Higher readings are generally found in those strata which represent the principal deposition zones. Somewhat lower readings toward the surface are a result of some post-occupational buildup of soil, while the lower readings toward bedrock reflect the sterile soil with some bioturbation of cultural materials and refuse. All site readings are higher than those off-site (Table 3).

Potassium

Cornwall (1958:157) has noted that the alkali-metals, sodium and potassium, though ubiquitous as traces, have salts too soluble for preservation in important amounts at archaeological sites in moist environments. An examination of Table 3 reveals no patterning of potential cultural relevance, although high amounts occur in some surface levels, perhaps a reflection of post-occupation deposition from plant and animal matter.

Calcium

Values for calcium within the site are clearly higher than off-site samples (Table 3), a distinct reflection of cultural deposition factors. It also is evident that higher readings correspond generally with those zones of highest human use/disposal. Overall, readings when plotted would approximate a bell-shaped curve, the highest readings in the main midden strata. One exception, a lower reading in the middle of Stratum II of Unit 8S-8W, could represent a zone of lesser activities/deposition.

Manganese

Readings in parts per million of manganese show no significant variation between on-site and off-site samples.

Phosphate Fractionation

Eidt (1985:181) has stated that all the macro- and micronutrients that can be investigated in anthrosol analysis, phosphorus (as phosphate) is most reliable. A relatively recent and revealing test of human modified soils and sediments involves the separation of phosphate into three main types by a procedure known as fractionation (Chang and Jackson 1957). This is a non-overlapping separation test based on variation in solubilities of the three types of phosphate (cf. Eidt 1977). Fraction I is easily extractable phosphate, Fraction II is the tightly bound or occluded iron and aluminum phosphates, and Fraction III is apatite and other tightly bound calcium phosphates (all expressed in parts per million and then as a percentage of the total inorganic phosphorus). Results from the Middle Mule Pond Site are presented in Table 3.

The outcome demonstrates the clear dichotomy in values between the sterile off-site samples and the site deposit. While only a few samples were run, all from Unit 9N-1E, it appears that even Stratum II, a transitional zone in this unit between the sterile sub-surface and the richest deposit, contains high levels, although less than one-half of those readings from the stratum above.

Eidt (1984:43) notes that "the higher the Fraction II values, the greater the age when comparing samples from the same horizons." The results do not reflect significant age differences from top to bottom (0-138cm) of this unit. However, bioturbation factors may have obscured differences. In other northern California soil/sediment studies (Ritter 1987a, 1987b, 1988) sites have total phosphate ratios for on-site versus off-site values from 2:1 to 10:1, a reflection of the relative amounts of site use, ranging from presumed small camps to moderate-sized occupation locales. This site has a maximum ratio of 10:1, substantiating the "major," albeit somewhat spatially confined, occupation locale. This is the case, at least, during times of occupation that resulted in the principal deposition. It is noteworthy that Fraction II readings from off-site are vary low in comparison to the midden suggesting recent soil development where the sample was taken. More informative results from this test might be forthcoming by running numerous additional on and off-site samples.

Conclusions

Most of the results of the soil/sediment testing are equivocal. Conclusions are plagued by a small number of samples and the absence of cross-site trenching to gain a better grasp of the site stratification. Still, there are certain insights that have been gained by the analyses.

The site exhibits the consequences of a complex interplay of human and natural events, events that were not uniform across the site. The deposit is obviously deepest and most complicated in the central portion of the site where more human activities and/or deposition-forming events occurred. Chemical tests and the physical nature of the deposit show that this place was an important habitation location for a relatively long period of time, for hundreds, even thousands of years.

The initial site occupants found a foothill terrace location bordering the Sacramento valley and adjoining a major tributary stream to the Sacramento River. A southerly aspect provided good insulation. The lower portions of the deposit (variable between Strata II-IV depending on unit) may signify more intermittent use than during the period of principal occupation, when use was relatively intense as illustrated by dark, thick midden and high chemical readings, especially P and Ca. The surface levels show a slight drop-off in reading levels indicative of less intense use. But this is no doubt in part due to soil-sediment contributions that are post-occupational.

The deposit exhibits bioturbation from burrowing animals, roots, and human events (inhumation, cooking pits, and possible structure construction and destruction). This has tended to somewhat obscure stratigraphic relationships. There is no evidence of any "natural" erosional or depositional events of any magnitude at this site, possibly only minor sheetwash erosion and deposition following burning or vegetation removal, and bank slumping adjoining the present creek bed.

Deposit buildup is an outcome of trash deposition, vegetation decomposition, residue from burning, possibly minor importation of sediments for such activities as packing a house floor with clay, covering portions of a structure with soil, leaching acorns in a prepared pit of sand, human and animal defecation, human burial, and animal decomposition, etc. These operations varied over time, less intensive at first, more so later, with final abandonment. Such activities also varied over the site over time. Horizontal and vertical variation of cultural significance is quite apparent. Further geoarchaeological studies at this site would undoubtedly provide more information of value.

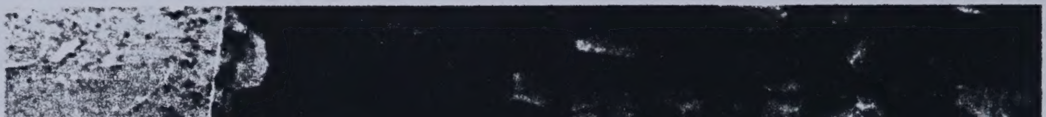


Figure 6. Feature 3.

FEATURES

Five features were encountered and formally recorded during excavations. Soil, ash, bark, and/or charcoal samples were recovered from these features.

Feature 1

This feature was first encountered in the southwest corner of Unit 8S-8W at a depth of 5 cm. Characterized as organically decomposed soil, this oxidized area included fire affected rock (FAR) and a small amount of charcoal. The feature, 5-6 cm in depth, was much lighter in color than the surrounding darker (Munsell 10YR 2/2, very dark brown, dry) soils. Artifact residuals from the flotation sample yielded a small bone fragment and six small pieces of debitage (obsidian and metavolcanic). Other artifacts associated with this feature in the surrounding matrix included 63 pieces of debitage (obsidian, metavolcanic and chert).

Feature 2

Two distinct areas that contained clumps of ashy materials were concentrated near the northeastern wall of Unit 3S-8W at a depth of 47 to 50 cm below the surface. The soil coloration was significantly lighter (Munsell 5YR 4/6, yellowish red, dry) and, although the feature appeared isolated from the rest of the unit, it probably extended into the unit to the east. Although flotation produced only minimal debitage from the feature, numerous faunal materials, shell fragments, charcoal, and FAR were interspersed within the adjacent soil. This feature probably represents a burning episode of some type.

Feature 3

A patterned concentration of horizontally placed flat cobbles spanned nearly the entire eastern half of 9N-14W (Figure 6) and also extended into the adjacent unit to the east. The appearance of a lighter loam-silty type soil lay atop the slightly oxidized rock tops beginning 21 cm from the surface. Presumably a nearly intact rock cooking-oven, this feature measured 7 to 10 cm in depth, 90 cm in length, and 44 cm wide. A large metavolcanic flake, shell and bone fragments, charcoal, and baked-red soil were all found in conjunction with this bed of flat rocks.

Feature 4

The excavation of Unit 8S-11E exposed a generally circular cluster of rocks, assumed to be a cooking area, at a depth of 38 to 40 cm. Centrally located in the eastern half of the unit, this concentration of FAR encircled clumps of charcoal, ashy and decomposed soil, and shell fragments. A thin ash lens was also apparent in the northwest corner at the same level and, although it appeared mutually exclusive of the circular FAR area, it was found in association with charcoal, debitage, bone and shell fragments.

Feature 5

Well-defined and preserved bark slabs were encountered in Unit 8S-5E at 73 cm below the surface. A soft, dark ashy midden was associated with these bark pieces which are probably from gray pine (*Pinus sabiniana*). Throughout this feature spots of white ash and oxidized midden were intermittently associated with the bark, FAR, obsidian flakes, shell beads, a single human maxillary tooth found at the 80-90 cm level, and a human mandibular canine tooth at 110-120 cm. As excavation progressed, it became apparent that the bark slabbing was extensive. It continued to protrude nearly halfway into the unit from the east wall down to a depth of 130 cm. This feature, potentially indicative of a burial cover or post-internment burning, is noted for the large amount of edge-modified obsidian pieces. *Olivella* and clamshell disk beads were found throughout, validating a likely burial association.

BURIALS

No human interments were identified during the excavations. However, 19 fragments of human skeletal material and teeth were inadvertently collected and later identified within the faunal assemblage (refer to Table 35). All were later reburied at the site, each in their original provenience.

The majority, 11 specimens, was found in Unit 8S-8W. Fragments of a small navicular and a metacarpal were found at 50-60cm and 80-90cm, respectively. A predominant concentration of bone occurred between 150 and 180cm and included fragments of a metacarpal, phalanxes, cervical vertebrae, and a mandibular premolar. This concentration co-occurs with shell beads, two corner-notched projectile points, and a mano, which may be associated with the burial.

Human teeth, which may collectively constitute portions of a burial, were found in Unit 8S-5E from approximately 75cm to 130cm in depth. These are described above under Feature 5.

The 20-40cm levels of Unit 3S-8W yielded three pelvis fragments in association with a pestle, an incised stone, and a shell bead.

Elsewhere, Unit 9N-1E yielded fragments of a tibia, and 7N-8E produced a phalanx and a palatine. The latter were found near a hammerstone and a Gunther series projectile point. However, direct associations cannot be established due to bioturbation factors.

CULTURAL ASSEMBLAGE

Cultural materials recovered from CA-SHA-1544 include 8,699 artifacts, excluding features, unmodified bone, and seeds and shell fragments. These materials have been separated into four categories: flaked stone artifacts, groundstone artifacts, bone tools, and ecofacts, which includes the results of faunal and paleobotanical analyses.

Flaked stone artifacts, the largest single category of artifacts recovered from the Middle Mule Pond site, (n=8,631) represent 99.2% of the total cultural assemblage. The artifacts were assigned into the following specified categories on the basis of their morphological characteristics (refer to Appendix A for technological attributes, lithic terminology and definitions).

Debitage
Cores
Retouched tools: edge-modified pieces, unifaces, and bifaces
Projectile points

Both local and imported materials were used to fashion the chipped stone artifacts (Table 4). Local volcanic and metavolcanic materials broadly defined as "metavolcanic" include rhyolite, basalt, and greenstone. Obsidian was imported from two localities, the Grasshopper Flat/Lost Iron Wells/Red Switchback (GF/LIW/RS), and Tuscan glass sources. Sedimentary rocks which were

TABLE 4
Flaked Stone Artifacts by Raw Material

Artifact	Obsidian		CCS		Igneous		Quartz		Row Total	
Type	n	%	n	%	n	%	n	%	n	%
Debitage	5226	65.1	131	1.6	2668	33.2	4	0.1	8029	100
Cores	12	20.3	8	13.8	39	66.1	--	--	59	100
Edge-Mod.	225	71.0	13	4.1	77	24.3	2	0.6	317	100
Unifaces	10	43.4	4	17.4	9	39.2	--	--	23	100
Bifaces	80	86.1	12	12.9	1	1.0	--	--	93	100
Pro. Points	104	94.5	6	5.5	--	--	-	--	110	100
Totals	5657	65.5	174	2.0	2794	32.4	6	0.1	8631	100

utilized include chert (Franciscan) and an unnamed "quartzite-like chert" (Ron Rogers, BLM geologist, personal communication: 1990) (n=13, 7.5% of the total ccs; both are cryptocrystalline silicates and hereafter referred to as "ccs"), and quartz (macrosilicate).

Debitage

This artifact category includes unmodified, residual lithic flakes and shatter produced from reduction of the parent pieces (i.e., cores, flakes), or from the manufacture of flaked stone tools. Debitage can represent one or more stages of reduction of the raw material from the original form to the finished stage (Nilsson 1988:4, Crabtree 1982:32).

All debitage collected from the site (n=8029) was divided into three broad classes: 1) primary decortication; 2) secondary decortication; and 3) tertiary/interior (including shatter). Additionally, the debitage from the unit 3S-8W, representing 13.2% of the total debitage recovered from CA-SHA-1544, was further analyzed and classified according to the reduction stages developed by Crabtree (1982), Flenniken (1980), and adapted by Nilsson (1988). Debitage frequencies by unit and type are presented in Table 5. Tertiary or interior flakes comprise the majority (67.3%) of the total debitage and also occur as the foremost flake type in all units.

One unit, 3S-8W, was selected for intensive debitage analysis. It was anticipated that the combined specialized analyses (radiocarbon, shell and faunal studies) directed specifically at 3S-8W, a unit of maximal depth, artifact concentration, and stratigraphic complexity, would enable expedient integration and, by extension, synthesis of less intensive data from other units at the site.

TABLE 5
Total Debitage by Unit and Type

	Primary		Secondary		Tertiary		Row Total	
Unit	n	%	n	%	n	%	n	%
Vandal Backdirt	31	8.0	170	44.5	182	47.5	383	100
3S-8W	56	5.3	292	27.5	712	67.2	1060	100
8S-11E	37	6.3	210	35.4	345	58.3	592	100
9N-1E	36	5.3	213	31.4	430	63.3	679	100
21N-3E	3	3.7	23	28.0	56	68.3	82	100
8S-5E	38	4.6	258	31.4	526	64.0	822	100
25S-12E	17	4.3	111	28.2	266	67.5	394	100
7N-8E	21	2.1	158	16.3	799	81.6	978	100
8S-8W	44	4.1	394	36.5	641	59.4	1078	100
9N-14W	46	4.4	257	24.1	763	71.5	1066	100
17S-12E	50	5.6	167	18.7	677	75.7	894	100
TOTALS	379	4.7	2253	28.0	5397	67.3	8029	100

It was acknowledged prior to the analysis of 3S-8W that small pressure flakes may not be present due to the use of ¼" screen for this unit during excavations. A cursory visual inspection of other units and column samples does, however, recognize the presence of pressure flakes in the Middle Mule Pond collection. Refer to Appendix B for the attribute-coding format utilized for this intensive analysis.

Some 654 pieces, or 61.7% of the total debitage from 3S-8W, are "identifiable" flakes. Debitage is defined as "identifiable" when flakes exhibit complete platforms and terminations, and greater than 50% of their margins are intact (see Table 6 for identifiable debitage frequencies by material and type and Table 7 for debitage frequencies by type and level).

Metavolcanic: Very fine to fine-grained local rhyolitic, basaltic, and other metavolcanic materials comprise the majority (n=341, 52.1%) of the identifiable debitage. Stream-rounded cobbles and other local toolstone are dominated by these rhyolitic, basaltic and metavolcanic materials and were probably collected in and around the vicinity of the waterway. Although many of these metavolcanic specimens maintain a total cortical area of 1-33% (n=55, 16.1%), most have no cortex at all (n=199, 58.4%). This group of material typifies early to late core reduction strategies in the lithic assemblage and, by inference, suggests the occupants close proximity to the raw material source (Shackley, in Bayham et al. 1986:435). Although Unit 3S-8W is very near the streambed, for reasons not understood there remains a paucity of primary reduction flakes of metavolcanic materials in Unit 3S-8W.

Metavolcanic debitage, although containing the largest and greatest flake length range (7.1-60.3 cm) of all material types, is often recorded as angular shatter (n=77, 22.6%), devoid of any cortex. Limited evidence for the bipolar reduction of metavolcanic materials (n=1, 0.3%) is also present.

Obsidian: Imported obsidian constitutes 46.2% (n=301) of the identifiable debitage. Visual sourcing suggests the presence of two geochemically distinct obsidians within the 3S-8W unit (refer to Obsidian Hydration and Sourcing section). Overall, Tuscan obsidian predominates (n=218, 72.2%) over glass from the vicinity of Grasshopper Flat/Lost Iron Wells/Red Switchback (GF/LIW/RS) (n=84, 27.8%) sources.

Of the identifiable obsidian debitage, few flakes are classed as primary decortication (n=28, 9.3%), and much of this debitage is indicative of an early core reduction (n=127, 42.2%).

Obsidian at this site has the most variable range of flake types of any toolstone. Those debitage categories in which obsidian predominates over other material types by percentage are early core reduction and bipolar reduction (2.6%) with eight flakes represented. Obsidian specimens are additionally the only material type found in the early bifacial thinning (n=2, 1.6%), bulbar (n=5, 1.6%), and edge preparation (n=1, 0.3%) flake type categories. It should be reiterated here that the paucity of pressure flakes, often associated with obsidian reduction strategies, may be attributed to the use of 1/4" screens for 3S-8W rather than the absence of this reduction strategy within this unit.

The relatively small size of obsidian flakes (mean length: 12.9 mm; mean width: 11.4 mm) may reflect more the original size of the parent material rather than the type of reduction strategies utilized. Tuscan obsidian nodules are known to have an average diameter of 7 to 10 cm (although they may vary in size from 3 to 13 cm) and are generally thought to be reduced by splitting the small cobble/nodule in bipolar fashion. It is probable that resource stress on the Tuscan obsidian source may have placed limitations on procurement of the larger cobbles in later prehistoric periods and this would account for the typically smaller average debitage size found at CA-SHA-1544.

CCS: CCS (n=12, 1.8%) of limited flake length (range 7.8-20.1 cm) and color (shades of mahogany and brown) often occurs in early to late core reduction stages. The stone is usually of fair quality, exhibiting sporadic inclusions and phenocrystic veins. Thermal alteration of the toolstone is commonly revealed by a glazed and/or waxy patina. Much of this flake stone exhibits from 1-33% total cortex on its surface (n=8, 66.6%). Reduction strategies for chert infer non-local acquisition of this material in view of the absence of primary reduction flakes or cobble types.

Quartz: No identifiable debitage of quartz was recorded for Unit 3S-8W.

TABLE 6
Identifiable Debitage Frequencies By Material and Type
Unit 3S-8W

	PRI		ECR		LCR		EBTF		BULB		EPREP		SHATT		BIP		WEDGE		TOTAL	
Material	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Obsidian	28	9.3	127	42.2	75	24.9	2	0.7	5	1.6	1	0.3	50	16.7	8	2.6	5	1.7	301	100
CCS	--	--	3	25.0	8	66.6	--	--	--	--	--	--	1	8.4	--	--	--	--	12	100
Metavol.	10	2.9	53	15.6	191	56.0	--	--	--	--	--	--	77	22.6	1	0.3	9	2.6	341	100

PRI= Primary decortication
ECR= Early Core Reduction
LCR= Late Core Reduction

EBTF= Early Bifacial Thinning
BULB= Bulbar
EPREP= Edge Preparation

SHATT= Shatter
BIP= Bipolar
WEDGE= Wedge/Cortical

TABLE 7

Identifiable Debitage Frequencies by Type and Level

(For key see Table 6)

Unit 3S-8W

	PRI		ECR		LCR		EBTF		BULB		EPREP		SHATT		BIP		WEDGE		TOTAL	
Level	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
0-10	2	8.7	7	30.4	11	47.8	--	--	--	--	--	--	3	13.1	--	--	--	--	23	100
10-20	3	6.4	20	42.6	18	38.3	--	--	--	--	--	--	5	10.6	1	2.1	--	--	47	100
20-30	2	7.7	3	11.6	17	65.5	--	--	--	--	1	3.8	1	3.8	1	3.8	1	3.8	26	100
30-40	2	7.4	17	63.0	5	18.5	--	--		3.7	--	--	1	3.7	1	3.7	-	--	27	100
40-50	3	8.1	18	48.8	10	26.9	--	--	--	--	--	--	5	13.5	1	2.7	--	--	37	100
50-60	4	10.5	16	42.2	14	36.8	--	--	--	--	--	--	3	7.9	--	--	1	2.6	38	100
60-70	1	3.0	5	15.2	18	54.5	--	--	2	6.1	--	--	5	15.2	1	3.0	1	3.0	33	100
70-80	4	10.6	6	15.8	17	44.7	--	--	--	--	--	--	10	26.3	--	--	1	2.6	38	100
80-90	8	12.7	10	15.9	23	36.5	--	--	1	1.5	--	--	19	30.2	--	--	2	3.2	63	100
90-100	1	2.5	19	47.5	12	30.0	--	--	--	--	--	--	5	12.5	3	7.5	--	--	40	100
100-110	1	2.1	12	25.5	19	40.5	--	--	--	--	--	--	14	29.8	--	--	1	2.1	47	100
110-120	3	5.1	12	20.3	24	40.7	--	--	--	--	--	--	17	28.8	--	--	3	5.1	59	100
120-130	1	2.2	11	24.4	26	57.8	--	--	--	--	--	--	7	15.6	--	--	--	--	45	100
130-140	--	--	8	18.2	24	54.5	2	4.5	--	--	--	--	8	18.2	1	2.3	1	2.3	44	100
140-150	1	2.1	8	17.0	22	46.7	--	--	1	2.1	--	--	13	27.8	--	--	2	4.3	47	100
150-160	1	5.0	9	45.0	3	15.0	--	--	--	--	--	--	6	30.0	--	--	1	5.0	20	100
160-170	--	--	1	5.6	11	61.0	--	--	--	--	--	--	6	33.4	--	--	--	--	18	100
170-180	1	50.0	1	50.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	100
TOTALS	38	5.8	183	27.9	274	41.9	2	0.3	5	0.8	1	0.2	128	19.6	9	1.4	14	2.1	654	100

TABLE 8

Unidentifiable Debitage By Level and Material from Unit 3S-8W

	Obsidian		CCS		Metavolcanic		Quartz		Row Total	
Level	n	%	n	%	n	%	n	%	n	%
0-10	14	100.0	--	--	--	--	--	--	14	100
10-20	29	93.5	--	--	2	6.5	--	--	31	100
20-30	24	75.0	--	--	8	25.0	--	--	32	100
30-40	20	90.9	--	--	2	9.1	--	--	22	100
40-50	25	83.4	--	--	5	16.6	--	--	30	100
50-60	18	78.3	--	--	5	21.7	--	--	23	100
60-70	14	58.4	1	4.1	9	37.5	--	--	24	100
70-80	19	82.6	--	--	4	17.4	--	--	23	100
80-90	9	37.5	4	16.7	11	45.8	--	--	24	100
90-100	18	62.1	1	3.4	10	34.5	--	--	29	100
100-110	28	75.7	--	--	9	24.3	--	--	37	100
110-120	15	53.5	--	--	12	42.9	1	3.6	28	100
120-130	13	81.3	1	6.2	2	12.5	--	--	16	00
130-140	16	66.6	1	4.2	7	29.2	--	--	24	100
140-150	22	68.8	--	--	10	31.2	--	--	32	100
150-160	3	27.3	--	--	8	72.7	--	--	11	100
160-170	--	--	--	--	3	100.0	--	--	3	100
170-180	1	33.4	--	--	2	66.6	--	--	3	100
TOTALS	288	70.9	8	2.0	109	26.9	1	0.2	406	100

The Unidentifiable Debitage classification, which includes all materials, was previously defined as those flakes with a missing and/or broken platform. A flake is also considered unidentifiable in this analysis when it is missing its terminal end and/or greater than 50% of either margin. Four hundred and six pieces (38.3%) of the debitage from Unit 3S-8W were recorded as "unidentifiable." Table 8 represents the unidentifiable debitage from Unit 3S-8W by level and material.

Unidentifiable flakes of obsidian are prevalent throughout the entire unit (n=288, 70.9%). A majority of these flakes have missing platforms, and often display an extensive cortical area on their dorsal surface. Metavolcanic materials appear in greater numbers only at levels 80-90cm and 150-160cm and are generally angular, blocky and lack a discernible platform.

Debitage Discussion: The intensive debitage analysis of Unit 3S-8W was combined with (1) a visual inspection of a randomly selected group of debitage collected from the looter's backdirt within the southeast quarter of the site (conducted in 1986 by lithic analyst Elena Nilsson, (Mountain Anthropological Research of Redding), and (2) an additional cursory inspection by the senior author of the entire debitage collection to formulate the following interpretation.

It is apparent that most, if not all, metavolcanic toolstone was obtained locally. Much of this material retains minimal cortex but, when present, it is often water-worn. Although ccs plays a minimal role as flaked stone material, cores and a limited number of retouched tools (i.e., edge-modified pieces and bifaces) have been fashioned from these rocks.

Obsidian constitutes 65.1% (n=5226) of the total debitage at CA-SHA-1544, and Tuscan glass dominates the collection. Derived from the closest source, Tuscan obsidian is easily transportable in its small nodular form to the site. Identifiable obsidian debitage demonstrates a near-complete reduction continuum: primary flakes with cortex, early and late core reduction, as well as evidence for early bifacial thinning, early pressure flakes, edge preparation flakes, bipolar reduction, and shatter.

Figure 7 illustrates vertical distribution changes in the total number of debitage material types from the Middle Mule Pond sample. Although obsidian appears to predominate in the most recent strata, this effect may be slightly amplified due to a few shallow (not exceeding 70 cm in

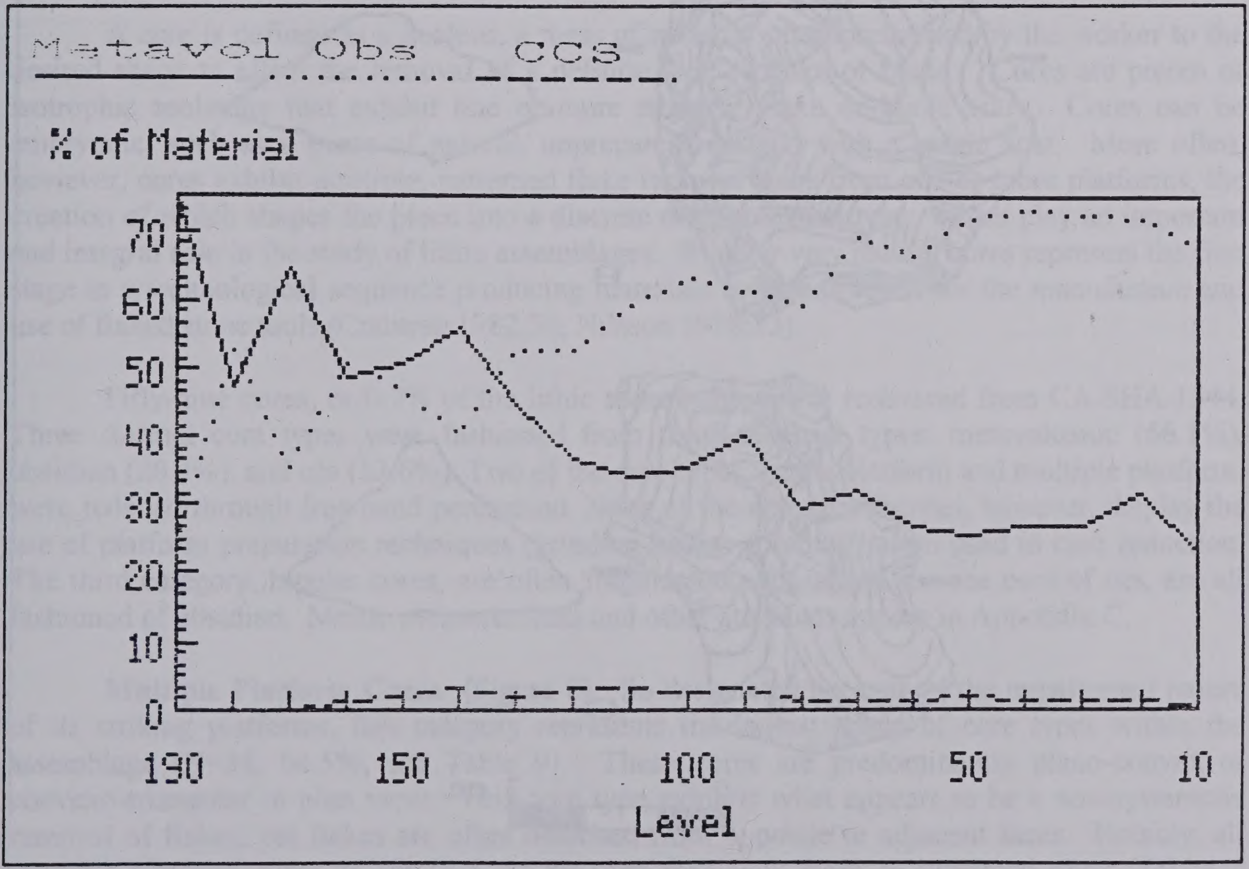


Figure 7. Total combined debitage by material and level.

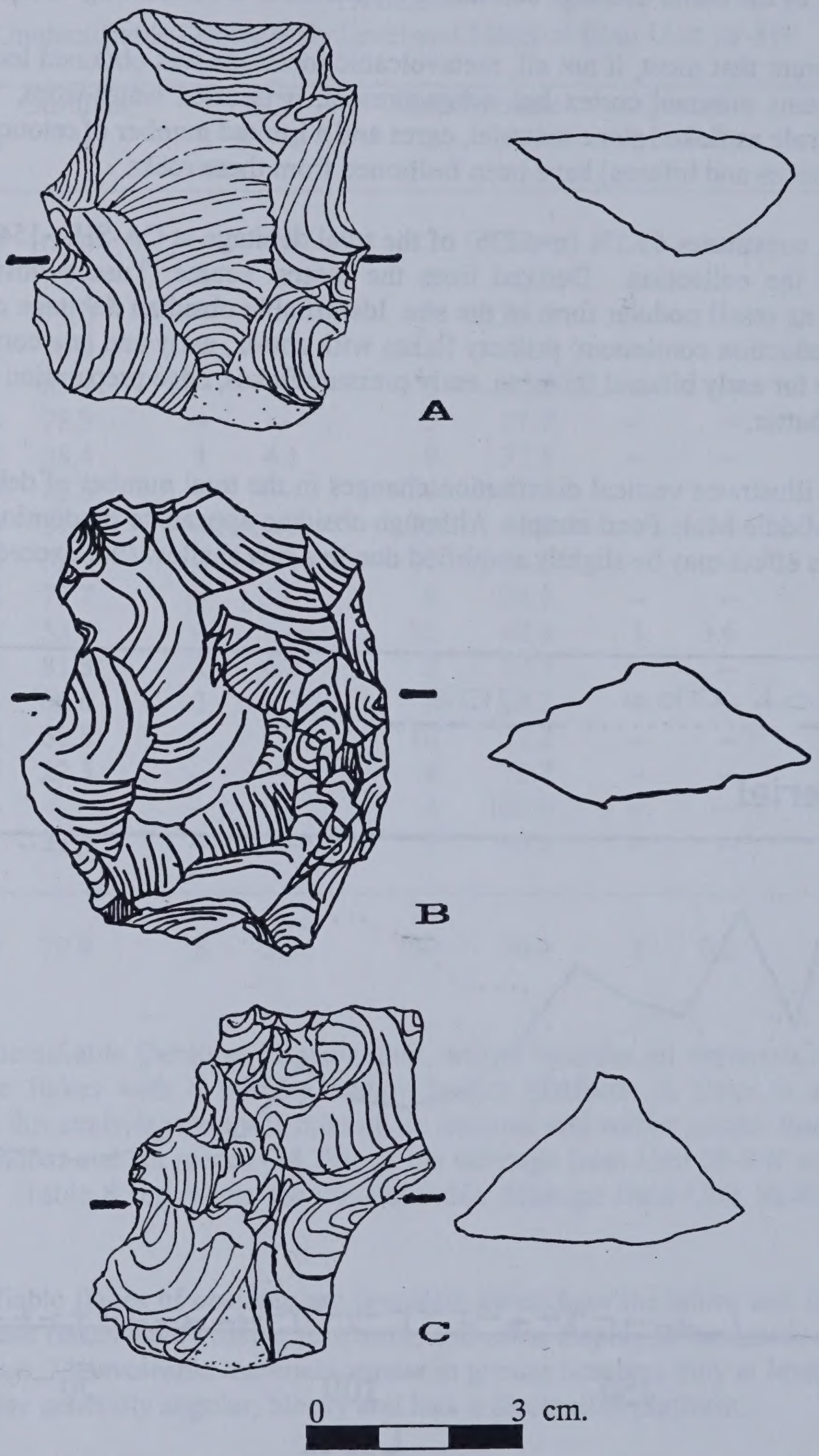


Figure 8. Multiple platform cores A) 97-566; B) 97-743; C) 97-384.

Noteworthy, however, is an obvious diachronic variability as suggested by the initial dominance of metavolcanic materials to the later prevalence of obsidian materials. Co-occurring with this shift, with few exceptions, is an initial marked higher frequency of ccs materials. The vertical distribution of reduction strategies in Unit 3S-8W change little throughout the deposit (refer to Table 7). Interchange between early core and late core reduction percentages move freely from level to level. Primary reduction, however, is more apparent at levels 50-60cm, 70-80cm, and 80-90cm.

It is not clear at this time whether this shift through time demonstrates a growing preference (resource intensification) for usable obsidian material, or, alternately, the selection of obsidian as the preferred reducible material of choice. Additionally, it is uncertain whether obsidian, particularly Tuscan, in the most recent strata, was perceived as high-cost procurement material, or merely a material that necessitated exhaustive (or intensive) utilization. Further intensive studies of debitage at Middle Mule Pond, particularly those replicative experiments which address typological and morphological placement of bipolar reductive remnants and wedge/cortical rind flakes (see Tyree 1992 regarding replicative experimentation with wedge flakes and their possible role in determining adaptive strategies in this locality) may answer these questions.

Cores

A core is defined as a nucleus, a mass of material often preformed by the worker to the desired shape to allow the removal of a definite type of flake or blade. Cores are pieces of isotrophic toolstone that exhibit one or more negative flake or blade scars. Cores can be embryonic, such as a piece of natural, unprepared material with a single scar. More often, however, cores exhibit multiple, patterned flake removal scars from one or more platforms, the creation of which shapes the piece into a discrete morphological type. Cores play an important and integral role in the study of lithic assemblages. By their very nature, cores represent the first stage in a technological sequence producing materials to be employed for the manufacture and use of flaked stone tools (Crabtree 1982:30; Nilsson 1988:13).

Fifty-nine cores, or 0.7% of the lithic assemblage, were recovered from CA-SHA-1544. Three distinct core types were fashioned from three material types: metavolcanic (66.1%), obsidian (20.3%), and ccs (13.6%). Two of the core types, single platform and multiple platform, were reduced through free-hand percussion. None of the above core types, however, display the use of platform preparation techniques (grinding and/or abrading) often used in core reduction. The third category, bipolar cores, are often fragmented and, except for one core of ccs, are all fashioned of obsidian. Metric measurements and other attributes appear in Appendix C.

Multiple Platform Cores (Figure 8): So designated because of the unpatterned nature of its striking platforms, this category represents the largest group of core types within the assemblage (N=38, 64.5%; see Table 9). These cores are predominantly plano-convex or convexo-triangular in plan view. This core type exhibits what appears to be a non-systematic removal of flakes, yet flakes are often detached from opposite or adjacent faces. Notably, all multiple platform cores of ccs (n-6, 15.8%) are fashioned from an unnamed chert (debitage counts for this material sub-type is a mere six flakes). This non-Franciscan ccs has quartz-like

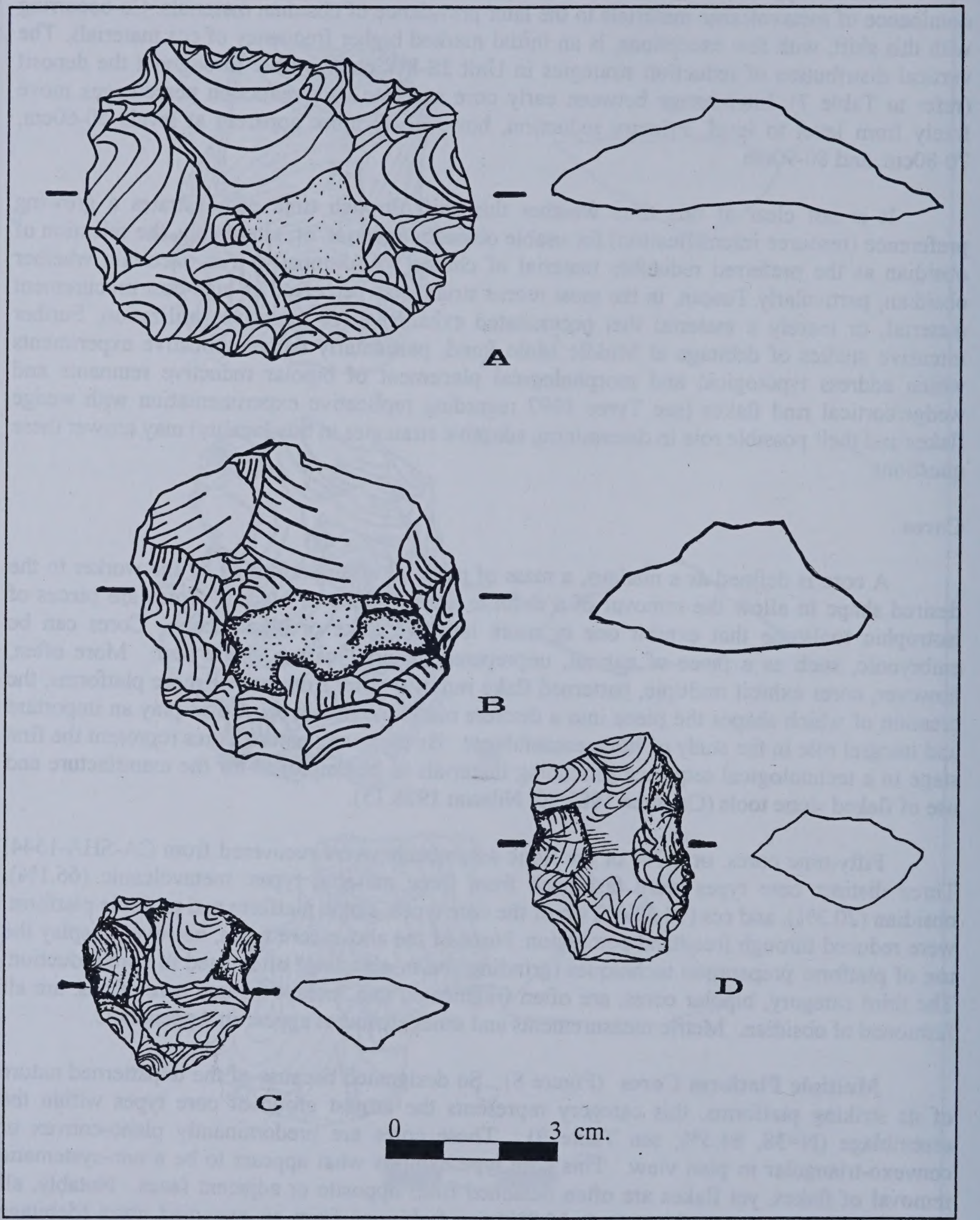


Figure 9. Single platform (A-B) and bipolar cores (C-D);
A) 97-237, B) 97-4; B) 97-833, C) 97–208.

TABLE 9
Core Type By Material

	Material						Range		Row Total	
	Metavol		CCS		Obsidian		Weight	Grid		
Core Type	n	%	n	%	n	%	(g/kg)	(mm)	n	%
I. Multiple Platform	32	84.2	6	15.8	--	--	12.0g/ 2.4kg	36.9mm/ 185.0mm	38	100
II. Single Platform	7	87.5	1	12.5	--	--	81.5g/ 817.0g	50.8mm/ 112.0mm	8	100
III.Bipolared	--	--	1	7.7	12	92.3	0.4g/ 23.4g	5.7mm/ 40.1mm	13	100
TOTALS	39	66.1	8	13.6	12	20.3	0.4g/ 2.4kg	5.7mm 185.0mm	59	100

characteristics. It is brittle, irregular, and the uneven breakage of this particular ccs material type may account for cores which appear experimental in nature. Collectively, all multiple platform cores (of both ccs and metavolcanic materials) have little similarity with regard to degree of remnant cortex. Remaining cortex on this core type is generally 0-33% (>75%), yet seven cores retain 34-67% of their cortex and two cores have 68-99% cortex. These cores generally exhibit a higher number of negative flake scars than the single platform cores. The high degree of residual cortex appears to reflect the local acquisition of the raw materials.

Single Platform Cores (Figures 9A-B): This core type is represented by eight specimens (13.5%) of variable shape. These cores have negative flake scars that originate from a single unidirectional platform and often display fewer flake scars than the multiple platform cores. Of the single platform cores, four display 1-33% remnant cortex and four others exhibit 34-67% cortex. The latter, again, suggests nearby accessibility of the raw materials.

Bipolar Cores/Elements (Figures 9C-D): As an alternative to free-hand percussion, cores or "elements" may be representative of the following reduction strategy. Bipolar technology involves resting the objective piece on an anvil and striking the opposite edge or end with a percussor. This action removes blanks from both ends and sometimes both faces of the piece simultaneously. The core, and often its resultant blanks, are characterized by heavily crushed, irregularly scarred platforms, pronounced and invasive step fractures, and negative scars on opposite faces and from opposite ends (Nilsson 1989:61).

TABLE 10

Core Type By Provenience

	I.Multpl Plat		II.Singl Plat		III.Bipolr		Row Total	
Level	n	%	n	%	n	%	n	%
Vl/Bkdrt	15	57.7	3	11.5	8	30.8	26	100
0-10	2	100.0	--	--	--	--	2	100
10-20	2	66.6	--	--	1	33.4	3	100
20-30	3	100.0	--	--	--	--	3	100
30-40	1	25.0	3	75.0	--	--	4	100
40-50	1	100.0	--	--	--	--	1	100
50-60	2	100.0	--	--	--	--	2	100
60-70	4	00.0	--	--	--	--	4	100
70-80	2	100.0	--	--	--	--	2	100
80-90	--	--	--	--	2	100.0	2	100
90-100	2	66.6	--	--	1	33.4	3	100
100-110	--	--	1	100.0	--	--	1	100
110-120	--	--	--	--	--	--	--	--
120-130	--	--	--	--	1	100.0	1	100
130-140	--	--	--	--	--	--	--	--
140-150	3	75.0	1	2.5	--	--	4	100
150-160	--	--	--	--	--	--	--	-
160-170	1	100.0	--	--	--	--	1	100
170-180	--	--	--	--	--	--	--	--
180-190	--	--	--	--	--	--	--	--
TOTALS	38	64.4	8	13.6	13	22.0	59	100

Thirteen cores (22%) have been reduced by the above mentioned method. All bipolar cores are fashioned of obsidian with the exception of one recovered from the vandal backdirt (SE quarter) of ccs. The use of obsidian may be attributed particularly to the small nodular size of the imported obsidian. Full exploitation of these small obsidian cobbles might have not been possible using typical free-hand percussion reduction techniques. Bipolar cores from CA-SHA-1544 are generally squared and/or blocky in shape, and exhibit various unpatterned flake removals and crushed platform ends. Some of these cores appear to be fragments (or elements) of larger pieces possibly attributable to extensive crushing when bipolar reduction is employed.

Core Discussion: Core types do not appear restricted by horizontal or vertical boundaries within the deposit (see Table 10). Data sets suggest that while metavolcanic is the predominant material in two of the three core "Type" categories, cores of obsidian dominate the bipolar core type (92.3%).

With regard to the number of cores present at the site it has been suggested that, assuming equal site-formation processes and minimum scavenging, the proportion of cores and debitage should be linear, in that a high frequency of debitage should be reflected in a relatively large number of cores. When the ratio of cores to debitage is low, the debitage may be the result of alternative technological processes such as facial tool maintenance and rejuvenation (Henry et al.1976; Patterson and Sollberger 1978; Shackley in Bayham et al. 1986:121).

Since no comparative evaluations can be made with intersite debitage types, direct frequency ratios of cores to debitage cannot be measured at this time. However, it may be posited that at CA-SHA-1544 the ratio of core vs. debitage material types may indicate an intensive preferential reduction of obsidian nodules, which because of their initial size, are ultimately reduced to unrecognizable chunks of angular shatter (as opposed to recognizable cores). Indeed, Farber and Neunschwander testing the relationship between formed artifacts and debitage within each material type category at the Fay Hill site (CA-SHA-1481) suggest:

> . . . the ratio of obsidian waste flakes to artifacts is somewhat higher than the ratios for basalt and cryptocrystalline. This might be an indication that obsidian was reduced differently, and to a greater extent, than basalt and cryptocrystalline. Again, economic use of obsidian is implied (1984:65).

Edge-Modified Pieces

This artifact category includes flakes or blades that exhibit alteration of their natural edge(s) by minimal, intentional flaking or by use resulting in edge attrition. Specimens were classified as edge-modified pieces only if they lacked distinct morphological attributes necessary for inclusion into other tool type categories such as unifaces (Nilsson 1988:28). Metric measurements and other attributes appear as Appendix D.

A total of 317 edge-modified pieces were recorded from CA-SHA-1544 (Table 11). Comprised predominantly of obsidian materials (n=225, 71%), this artifact category also includes metavolcanic types (n=77, 24.3%), ccs (n=13, 4.1%), and quartz (n=2, 0.6%) pieces.

It is notable that nearly half (n=146, 46.1%) of the total modified pieces were created from flakes that were unidentifiable, often lacking a discernible platform. The identifiable obsidian pieces, however, were fashioned from the most varied flake types in the collection. Although early core reduction flakes of obsidian are prevalent (n=40, 17.8%), specimens of late core (n=32, 14.2%), bipolar (n=14, 6.3%), bulbar flakes (n=11, 4.9%), and others are present.

The preferred location of retouch for most of the edge-modified materials is the margins or lateral areas (n=143, 45.2%) (see Table 12). Nilsson (1988:28). states that,

> . . .the modification of a lateral edge provides for a longer working surface than would end retouch and, depending on the intended function of the tool, might give speed and efficiency to a task where a shorter area of modification would be less appropriate.

TABLE 11
Edge-Modified Pieces By Material

	Flake Type																									
Material	PRI		ECR		LCR		EB TF		LBTF		ALT		BULB		EREM		SHATT		UNIDENT		BIPOLAR		MOD. COBBLE		ROW TOTAL	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Obsidian	3	1.3	40	17.8	32	14.2	6	2.7	2	0.9	2	0.9	11	4.9	1	0.4	1	0.4	113	50.2	14	6.3	--	--	225	100
Metavol	6	7.8	25	32.5	19	24.6	--	--	--	--	--	--	1	1.3	--	--	--	--	25	32.5	--	--	1	1.3	77	100
CCS	--	--	1	7.7	3	23.0	--	--	--	--	--	--	--	--	--	--	--	--	8	61.6	1	7.7	--	--	13	100
Quartz	1	50.0	1	50.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	100
TOTALS	10	3.3	67	21.1	54	17.0	6	1.9	2	0.6	2	0.6	12	3.8	1	0.3	1	0.3	146	46.1	15	4.7	1	0.3	317	100

PRI= Primary Reduction
ECR= Early Core Reduction
LCR= Late Core Reduction
EBTF= Early Biface Thinning
LBTF= Late Biface Thinning
ALT= Alternate

BULB= Bulbar
EREM= Edge Removal
SHATT= Shatter
UNIDENT= Unidentifiable
BIPOLAR= Bipolar
MOD COBBLE= Modified Cobble

TABLE 12

Edge-Modified Piece By Retouch Location and Shape

	LOCATION										SHAPE											
Material	Lat/Margin		Distal		Proximal		Combination		Unidentifiable		Straight		Convex		Concave		Sinuous		Combination		Notched	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Obsidian	110	48.8	15	6.7	1	0.4	51	22.7	48	21.4	112	49.8	61	27.2	27	12.0	22	9.8	2	0.8	1	0.4
Metavol	28	36.4	12	5.6	--	--	24	31.2	13	16.8	35	45.5	26	33.8	2	2.6	12	15.6	--	--	2	2.5
CCS	4	33.4	2	16.6	--	--	1	8.3	5	41.7	7	58.3	4	33.4	1	8.3	--	--	--	--	--	--
Quartz	1	50.0	1	50.0	--	--	--	--	--	--	--	--	2	100.0	--	--	--	--	--	--	--	--
TOTALS	143	45.2	31	9.7	1	0.3	76	24.0	66	20.8	154	48.6	94	29.7	30	9.5	34	10.7	2	0.6	3	0.9

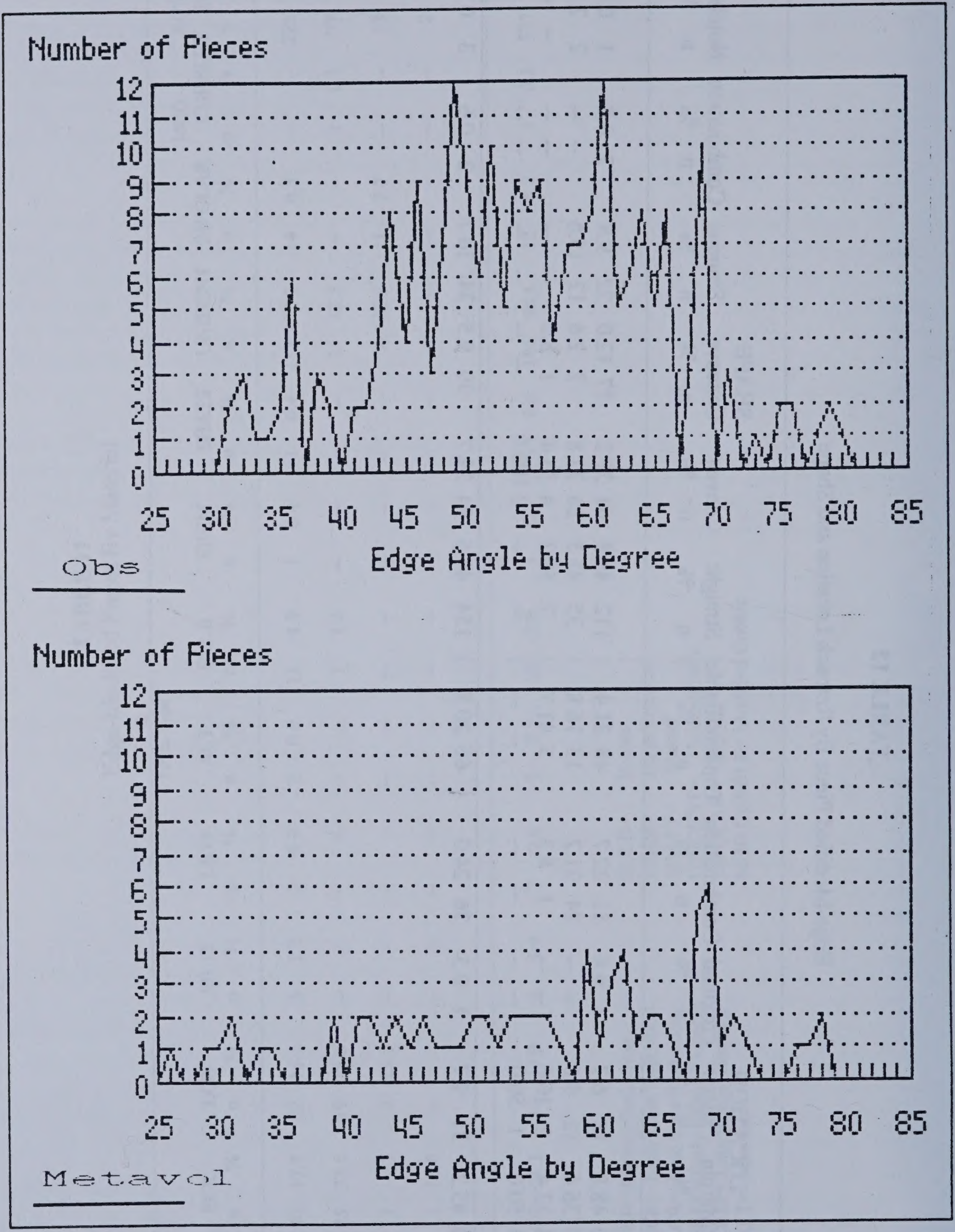


Figure 10. Edge angle measurements for Edge-Modified Pieces; obsidian (top) and metavolcanic (bottom).

Then, too, nearly 25% (n=76) of these tools are identified as a "combination" location. The latter has been defined as modification that includes both the lateral and distal areas. Notably, metavolcanic has more combination modification (n=24, 31.2%) than that of obsidian (n=51, 22.7%) or chert (n=1, 8.3%). The latter may reflect a more intensive use of local metavolcanic materials or demonstrate the utilization of stronger materials for more and/or varied tasks. So favored is lateral and distal modification that only one piece (from 8S-5E, 120-130cm) of obsidian, suggests proximal modification.

Although materials are varied, the edge angles for all materials appear to be concentrated between 46-66 degrees (Figure 10a-b) and the retouched edge predominately unifacial in form (n=296, 93%). While the mean edge angle for ccs is 63 degrees, interestingly both obsidian and metavolcanic materials are 55 degrees. Wilmsen (cf. 1974) denotes that this wide variation in edge angles, generally specified for "scraper tools", may suggest various tasks such as skinning, hide-scraping, cutting, wood and/or bone working, and heavy shredding or scraping, tasks one would expect at a village or campsite where multiple processing activities would occur. Replicative experiments by Wilmsen on edge angles of 50-75 degrees suggest that these particular angles would be most effective in absorbing heavy shear stress such as cutting, scraping, or shaping bone or wood (1974: 91-92). The variability of the edge-modified pieces indicates that they were most probably casually produced as needed for various tasks. Hayden concludes that unifacial polish and/or scalar modification most frequently connotes scraping, whereas bifacial modification generally indicates cutting (1979).

Each of two unusual obsidian pieces (97-0146, -0882) exhibits a non-contiguous, intentional notch along their lateral margin. The notch, resulting from percussion flaking, also shows limited signs of pressure flaking. The lunate curvature of the specified notched areas have measured edge angles of 48 and 57 degrees, respectively. These edge angle measurements are similar to the other edge modified pieces, yet because of the distinctive notched area, these tools are said to imply activities related to scraping and/or stroking. These tools may have been used as stripping or shredding instruments (Mary Carpelan, Shasta Tribe 1986: personal communication).

Microscopic use-wear studies were not undertaken on these specimens. On flakes of metavolcanic materials (other than obsidian), such wear may not always be evident. Bayham concedes that a 30x magnification with a binocular microscope "failed to reveal distinctive step fractures or striations" (in Doelle 1976:236) on meta-basaltic flakes (after developing controlled experiments for scraping and cutting specified types of bone and wood). Identification of these modified edges was achieved only by the use of microphotography. Potentially, then, with the high incidence of metavolcanic materials retrieved from CA-SHA-1544, flakes that have been examined only macroscopically may in future studies also be considered edge modified pieces.

Unifaces (Figure 11):

> Unifaces are formally shaped artifacts with invasive retouch that extends across only one face of the specimen. Artifacts are included in this category only if they lack sufficient morphological attributes necessary for placement into other tool types. Although often

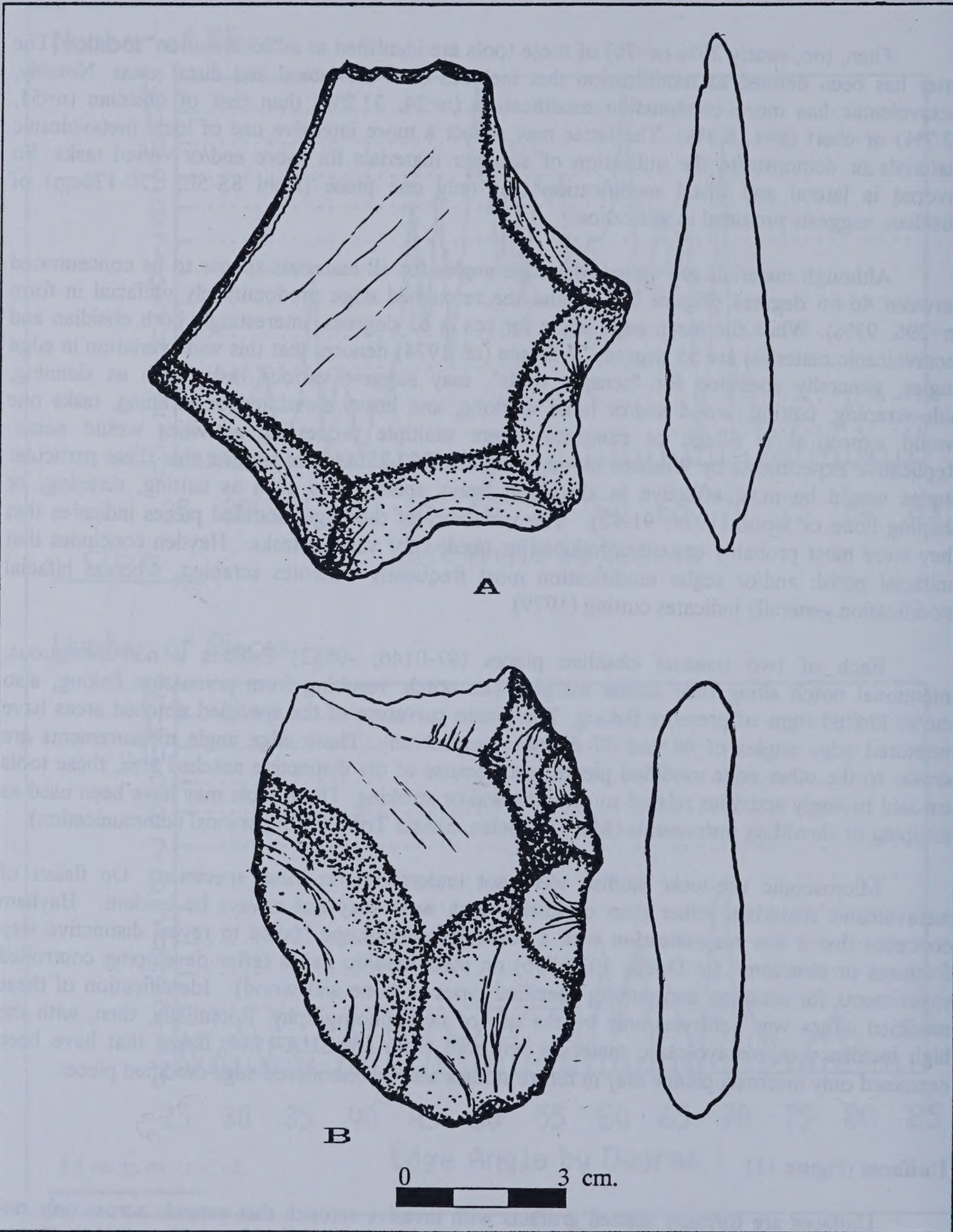


Figure 11. Unifaces of metavolcanic material; A) 97-205, B) -1374.

resembling edge modified pieces, being fashioned on flake blanks and exhibiting edge modification on one face, unifaces differ from these artifacts in two important ways. First, unifaces are characterized by purposeful, invasive retouch that covers at least 50% of the worked face. Conversely, edge modified pieces exhibit only marginal edge modification that may result from use and not intentional thinning or shaping. Second, unifaces are often more shaped than edge-modified pieces, the latter often reflecting simple, and perhaps, casual use (Nilsson 1988:25-26).

Twenty-three unifaces, representing 0.3% of the CA-SHA-1544 flaked stone assemblage, were recovered from eight units and the NW and SE quarters (Table 13). Unit 9N-1E contained the majority of the specimens, nearly equally divided by material types, (1 obsidian, 2 metavolcanic, and 2 ccs). The total collection of unifaces, however, suggests a generally greater emphasis on obsidian for the creation of unifacial tools (n=10, 43.5%) and a slightly less tendency toward the use of other metavolcanic materials (n=9, 39.1%). Unifaces of ccs total four, or 17.4%.

Nearly all the unifaces, although extremely variable in size, exhibit similar retouch location and shape. Nineteen (82.6%) display a convex shape with contiguous circumferential retouch modification.

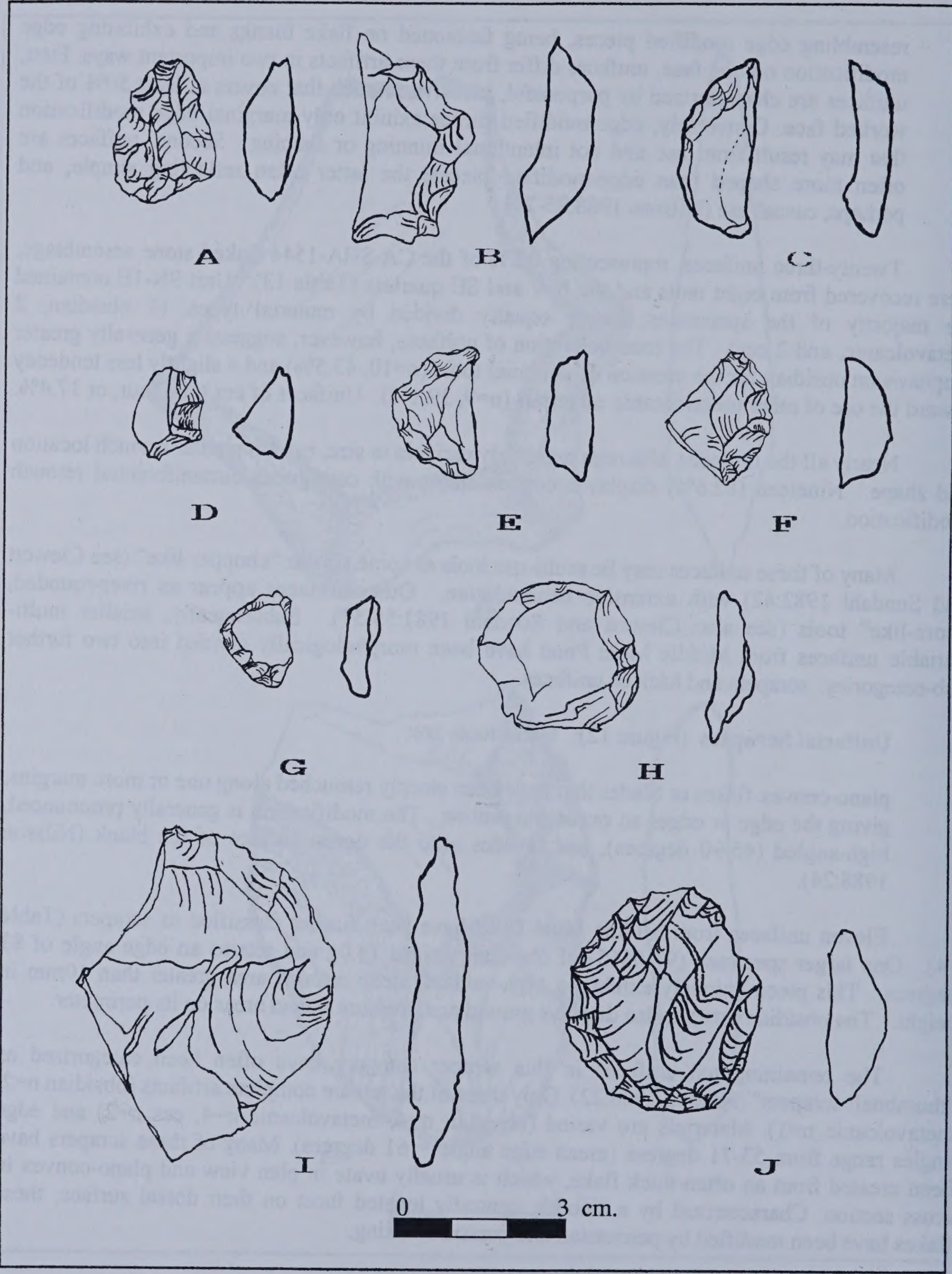
Many of these unifaces may be multi-use tools as some appear “chopper-like” (see Clewett and Sundahl 1982:42) with extensive denticulation. Other unifaces appear as river-rounded, “core-like” tools (see also Clewett and Sundahl 1981:55-57). Subsequently, smaller multi-variable unifaces from Middle Mule Pond have been morphologically divided into two further sub-categories: scrapers and McKee unifaces.

Unifacial Scrapers (Figure 12): These tools are:

> plano-convex flakes or blades that have been steeply retouched along one or more margins, giving the edge or edges an excurvate outline. The modification is generally pronounced, high-angled (45-90 degrees), and invades onto the dorsal surface of the blank (Nilsson 1988:24).

Eleven unifaces from Middle Mule Pond have been further classified as scrapers (Table 14). One larger specimen (97-0665) of obsidian weighs 14.0g and retains an edge angle of 83 degrees. This piece uniquely exhibits a high-vaulted, steep retouch area greater than 10mm in height. The obsidian scraper also displays ground and pressure flaked areas on its perimeter.

The remaining ten unifaces in this scraper category have often been categorized as "thumbnail scrapers" (Nilsson 1988:22). Only three of the ten are complete artifacts (obsidian n=2, metavolcanic n=1). Materials are varied (obsidian n=4, metavolcanic n=4, ccs n=2) and edge angles range from 53-71 degrees (mean edge angle = 61 degrees). Many of these scrapers have been created from an often-thick flake, which is usually ovate in plan view and plano-convex in cross section. Characterized by a smooth, centrally located facet on their dorsal surface, these flakes have been modified by percussion and pressure flaking.


A
B
C
D
E
F
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H
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0
3 cm.

Figure 12. Unifacial scrapers; A) 97-690; B) –812; C) -780; D) -1043; E) –834; F) –903; G) –1273; H) 1550; I-1375; J) –665.

TABLE 13

Selected Uniface Attributes

Catalog #	Unit	Level	Material	Condition	RetLoc	RetShape	EdAng
97-0013	vandal/bkdrt NW		obsidian	complete	entire	convex	53
-0052	vandal/bkdrt NW		metavol	complete	entire	convex	68
-0071	vandal/bkdrt NW		metavol	fragment	dis/prox	sinuous	66
-0187	vandal/bkdrt SE		ccs	fragment	dis/prox	convex	54
-0191	vandal/bkdrt SE		obsidian	complete	entire	convex	71
-0205	vandal/bkdrt SE		metavol	complete	entire	sinuous	63
-0233	vandal/bkdrt SE		obsidian	complete	entire	convex	2
-0532	3S-8W	160-170	obsidian	complete	entire	straight	68
-0665	8S-11E	70-80	obsidian	complete	entire	convex	80
-0690	8S-11E	90-100	obsidian	complete	entire	convex	63
-0780	9N-1E	50-60	ccs	fragment	entire	convex	64
-0812	9N-1E	70-80	metavol	fragment	entire	convex	64
-0844	9N-1E	90-100	ccs	fragment	entire	convex	64
-0869	9N-1E	110-120	obsidian	fragment	entire	convex	9
-0903	9N-1E	150-160	metavol	fragment	entire	convex	59
-1043	8S-5E	80-90	obsidian	fragment	entire	convex	59
-1086	8S-5E	100-110	metavol	complete	entire	sinuous	71
-1155	25S-12E	0-10	ccs	fragment	entire	convex	68
-1273	7N-8E	30-40	obsidian	fragment	entire	convex	64
-1374	8S-8W	0-10	metavol	complete	entire	convex	51
-1375	8S-8W	0-10	metavol	fragment	entire	convex	53
-1550	8S-8W	130-140	metavol	complete	entire	convex	53
-1891	17S-12E	50-60	obsidian	complete	entire	convex	67

RetLoc= Retouch Location
RetShape= Retouch Shape
EdAng= Edge Angle
Dis/Prox= Distal/Proximal

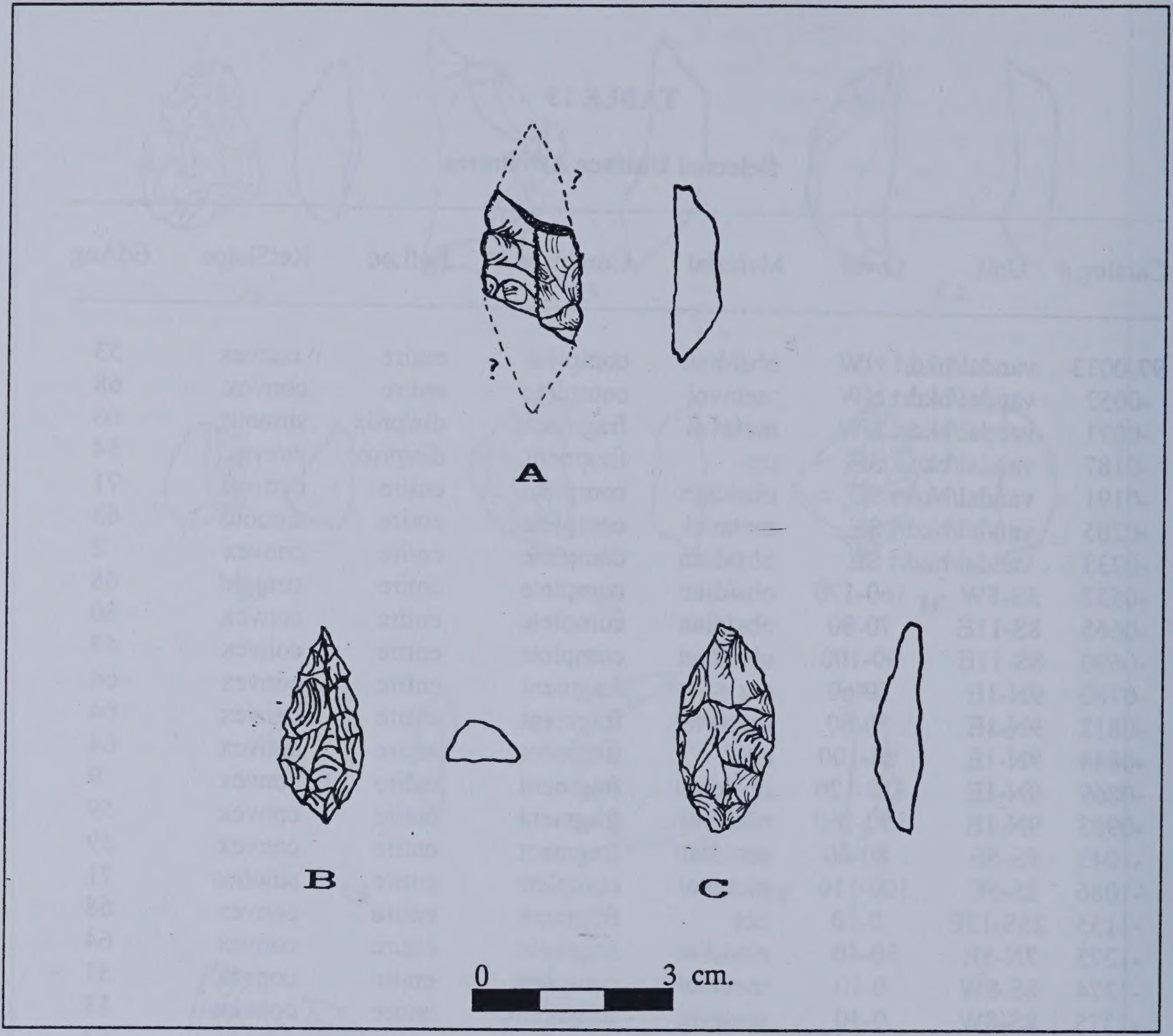


Figure 13. McKee unifaces; A) 97-1155; B) –1891; C) –233.

As mentioned above, microscopic use-wear studies were not conducted on these artifacts. It may be implied, however, that these retouched-tool types were used predominantly for the shaping and scraping of wood and bone (see Wilmsen 1974, Hayden 1979).

McKee Unifaces (Figures 13): McKee unifaces, first formally designated by Baumhoff (1982:13-15), are described as being made on blades with the final product being unifacial. Often these pieces have one or two distinct dorsal ridges and retouch on the ventral surface is limited usually to the bulb of percussion at the proximal end. In profile these appear "keeled" or "boat-shaped". Lateral margins are sometimes serrated. Since blade cores or blades are virtually absent at sites with McKees, it appears that in most cases they were made on "ridged flakes" rather than on true blades (Henn 1986:1).

Four unifaces from the Middle Mule Pond flaked stone assemblage, three obsidian and one of chert, have been grouped as McKees (see Table 14). Notably bi-pointed and keeled, these artifacts have been extensively shaped by percussion and pressure flaking which has produced a prominent central arris. Although some evidence of artifact thinning is present, one item (97-0532, visually sourced as Tuscan obsidian) has an extremely steep vault (9.41 mm high) which shows no evidence of final-stage thinning.

Baumhoff (1985:185) suggests allowable length parameters for McKees range between 3.0-6.0 cm and up to 8.0 gms in weight. Middle Mule Pond McKees closely resemble other artifacts locally (see Baumhoff 1982:13-15, 38-39, Appendix A; Baker 1984:97, #5). The Tower House report by Baker in particular, clearly shows McKee Uniface/keeled tools (#5a) with approximately the same metric data as artifact 97-233 (slightly smaller in length than the Baumhoff parameters). Similarities are also noted in the "The McKee Uniface: A Useful Timemarker in Northern California" (Henn 1986:1) where attribute mean lengths are described for the Sacramento River Canyon (I-5 project) excavations as 2.85 cm, mean widths as 1.86 cm, mean thickness as 0.57 cm and mean weights as 2.55 gms.

Scraper-like in mean edge angle, and potentially definitive as a temporal marker (Henn 1986:1), these McKees from Middle Mule Pond continue to invite speculation regarding ways they may have been utilized. It may also be noted, for purposes of future intra-site research, that three of the McKees were recovered from the SE quarter of the site.

TABLE 14
Selected Scraper and McKee Uniface Attributes

Catalog #	Unit	Level	UnifaceType	Len(mm)	Wid(mm)	Thick(mm)	Wt(gm)
97-0233	vandal/bkdrt SE		McKee	29.6	13.4	5.9	2.6
-0532	3S-8W	160-170	McKee	28.3	11.8	9.5	1.9
-1155	25S-12E	0-10	McKee	(14.6)	14.1	6.3	(2.0)
-1891	17S-12E	50-60	McKee	27.8	12.2	5.8	2.1
97-0191	vandal/bkdrt SE		scraper	16.3	14.8	2.6	0.8
-0665	8S-11E	70-80	scraper	38.7	32.7	10.4	14.0
-0690	8S-11E	90-100	scraper	24.9	16.9	8.5	3.7
-0780	9N-1E	50-60	scraper	(32.3)	(12.5)	8.0	(4.5)
-0812	9N-1E	70-80	scraper	(35.7)	19.7	10.2	8.1
-0844	9N-1E	90-100	scraper	22.2	(14.2)	6.9	(2.4)
-0903	9N-1E	150-160	scraper	(18.2)	(14.9)	7.4	(2.9)
-1043	8S-5E	80-90	scraper	15.6	(11.1)	11.0	(1.1)
-1273	7N-8E	30-40	scraper	15.8	(13.0)	4.5	(1.1)
-1375	8S-8W	0-10	scraper	56.6	(41.5)	7.6	(19.7)
-1550	8S-8W	130-140	scraper	26.6	26.0	5.1	4.8

( ) fragment; figure represents fragmentary measurement

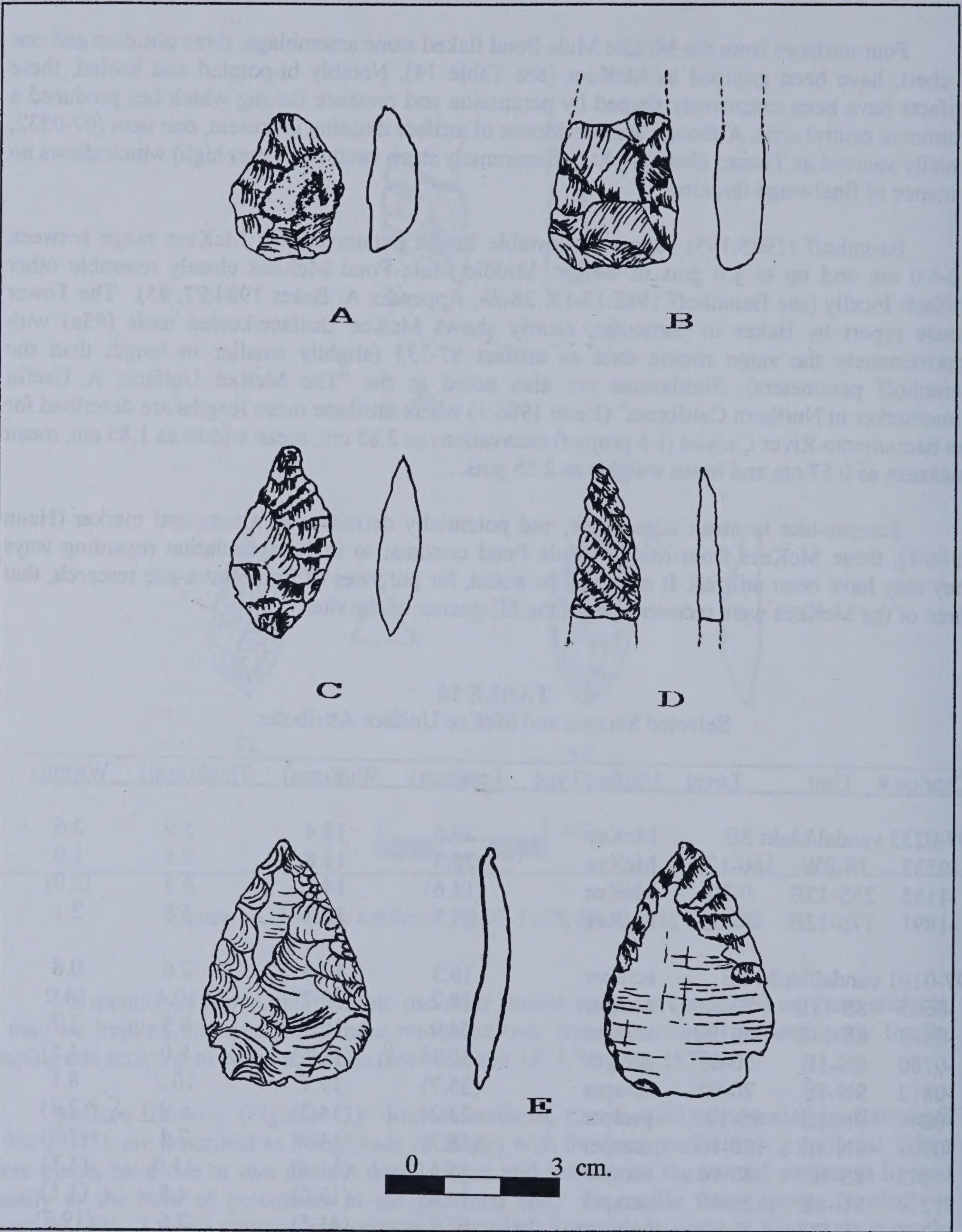


Figure 14. Bifaces; A) Stage 1, 97-1819; B) Stage 2, 97055; C) Stage 3, 97-753; D) Stage 4, 97-1330; E) Stage 5 (left, dorsal side; right, ventral side).

Bifaces (Figure 14):

Bifaces are artifacts that exhibit percussion or pressure flaking along both sides of the margins resulting in beveled edges. These artifacts are manufactured by reducing parent material into a bifacial form through sequential stages (blank-preform-product), or by simply selecting flaked stone byproducts (e.g. flakes, blades, broken tools) and fashioning these into bifacial implements.

Bifaces often play a dual role in northern California lithic assemblages, being used as both cores for production of usable flakes, and as tools (Banks 1984; Nilsson et al. 1988). This is particularly true with obsidian toolstone that arrived at many sites in a preformed state. As such, bifaces are described separate from the other retouched tool categories since, in many instances, they were used both for flake production and as tools (Nilsson 1988:31). It must be noted that the following analysis of bifaces, whether whole or fragmented, includes all bifacial pieces that do not directly exhibit shouldering or hafting elements. The one hundred and ten bifacial artifacts that display obvious shouldering and/or hafting elements are described under Projectile Points.

A total of 90 bifaces was recovered from CA-SHA-1544. Seventy-eight (86.7%) bifaces from two obsidian sources (XRF and visually sourced as GF/LIW/RS or Tuscan) are present. The remaining bifaces are made from ccs (n=12, 13.3%) (Table 15). Bifaces of basalt, metabasalt or other metavolcanic types are notably absent in this collection. Nearly all biface specimens are fragments (n=71, 78.9%), often missing the proximal and/or distal end. Bifaces were placed into one of five categories according to morphological characteristics. These "type" or "stage" divisions represent a reduction trajectory for bifaces at Middle Mule Pond. See Table 16 for an overview of bifaces by type and raw material. Metric measurements are given in Appendix E.

Type 1- Roughout: Seven bifaces of obsidian typify the "roughout" category. They are all very thick in cross-section and have sinuous edges. One unusually complete specimen (97-1819) is the heaviest in the collection (3.4 gm) and possibly is a split Tuscan obsidian nodule. It exhibits lateral margins that have been bifacially modified and a dorsal surface with remnant cortex. The size range for this Type I category is 10.3-24.0 mm in length (mean 16.4 mm).

Type II- Shaping: The largest group of bifaces from CA-SHA-1544 (n=45, 50.0%) exhibit a focus on the initial shaping of the artifact. Thirty-five bifaces of obsidian (77.8%) and 10 of ccs (22.2%) are distal and/or proximal fragments with transverse breaks. Most of these bifaces display obvious, yet unpatterned shaping/flaking patterns. A few bifaces, however (n=5), demonstrate that oblique or parallel flaking techniques were employed when shaped. Some fragments may also be the remnants of larger bifaces as evidenced by the reworking and/or bipolar reduction found on specimens 97- 0054, -0268, -0799, -0989, and -1569.

Two of these Type II bifaces (97-0055, and -0889) have been analyzed for hydration value and obsidian source location. One (97-55, no provenience), a mid-section, exhibits the common transverse break and is sourced as Tuscan obsidian at 2.1 microns. The other (97-889), recovered from the 130-140 cm level of 9N-1E, shows an unusual perverse fracture. The latter has been sourced to GF/LIW/RS and has a hydration value of 3.6 microns (see Obsidian Hydration section).

Table 15
Selected Biface Attributes

Catalog	Unit	Level	Condition	Flaking Pattern
97-0010	vandal bkdrt NW	----	unidentifiable	unpatterned
97-0018	vandal bkdrt NW	----	distal	unpatterned
97-0021	vandal bkdrt NW	----	complete	unpatterned
97-0024	vandal bkdrt NW	----	distal	unpatterned
97-0041	vandal bkdrt NW	----	unidentifiable	unpatterned
97-0046	vandal bkdrt NW	----	complete	unpatterned
97-0054	vandal bkdrt NW	----	unidentifiable	unpatterned
97-0055	vandal bkdrt NW	----	midsection	unpatterned
97-0061	vandal bkdrt NW	----	unidentifiable	unpatterned
97-0065	vandal bkdrt NW	----	dis/prox	unpatterned
97-0066	vandal bkdrt NW	----	dis/prox	unpatterned
97-0080	vandal bkdrt NE	----	dis/prox	unpatterned
97-0104	vandal bkdrt SW	----	complete	unpatterned
97-0136	vandal bkdrt SE	----	distal	patterned
97-0193	vandal bkdrt SE	----	dis/prox	patterned
97-0216	vandal bkdrt SE	----	unidentifiable	unpatterned
97-0231	vandal bkdrt SE	----	proximal	patterned
97-0261	vandal bkdrt SE -	---	distal	patterned
97-0267	vandal bkdrt SE	----	complete	unpatterned
97-0268	vandal bkdrt SE	----	complete	unpatterned
97-0311	3s-8w	10-20	dis/prox	unpatterned
97-0334	3s-8w	30-40	distal	unpatterned
97-0342	3s-8w	30-40	dis/prox	unpatterned
97-356	3s-8w	40-50	dis/prox	unpatterned
97-0410	3s-8w	80-90	distal	unpatterned
97-0442	3s-8w	100-110	unidentifiable	unpatterned
97-0464	3s-8w	110-120	dis/prox	unpatterned
97-0465	3s-8w	110-120	lateral	unpatterned
97-0485	3s-8w	120-130	dis/prox	unpatterned
97-0499	3s-8w	130-140	proximal	unpatterned
97-0513	3s-8w	140-150	proximal	unpatterned
97-0514	3s-8w	140-150	midsection	unpatterned
97-0515	3s-8w	140-150	dis/prox	unpatterned
97-0585	8s-11e	20-30	midsection	unpatterned
97-0586	8s-11e	20-30	midsection	patterned
97-0600	8s-11e	30-40	unidentifiable	unpatterned
97-0628	8s-11e	50-60	proximal	patterned
97-0664	8s-11e	0-80	distal	unpatterned
97-0692	8s-11e	90-100	complete	unpatterned
97-0718	9n-1e	0-10	dis/prox	unpatterned
97-0753	9n-1e	30-40	complete	patterned
97-0799	9n-1e	60-70	unidentifiable	unpatterned
97-0813	9n-1e	70-80	unidentifiable	unpatterned
97-0845	9n-1e	90-100	complete	patterned
97-0867	9n-1e	110-120	dis/prox	unpatterned

TABLE 15 (con't.)
Selected Biface Attributes

Catalog	Unit	Level	Condition	Flaking Pattern
97-0880	9n-1e	120-130	dis/prox	unpatterned
97-0889	9n-1e	130-140	dis/prox	unpatterned
97-0922	21n-3e	10-20	midsection	unpatterned
97-0957	8s-5e	10-20	complete	unpatterned
97-0976	8s-5e	20-30	dis/prox	unpatterned
97-0989	8s-5e	30-40	unidentifiable	unpatterned
97-1014	8s-5e	50-60	dis/prox	unpatterned
97-1042	8s-5e	80-90	dis/prox	unpatterned
97-1077	8s-5e	100-110	complete	patterned
97-1108	8s-5e	110-120	complete	patterned
97-1109	8s-5e	110-120	dis/prox	unpatterned
97-1124	8s-5e	120-130	complete	patterned
97-1153	25s-12e	0-10	lateral	unpatterned
97-1154	25s-12e	0-10	dis/prox	unpatterned
97-1220	25s-12e	60-70	unidentifiable	unpatterned
97-1229	25s-12e	70-80	unidentifiable	unpatterned
97-1230	25s-12e	70-80	complete	patterned
97-1239	7n-8e	0-10	dis/prox	unpatterned
97-1240	7n-8e	0-10	complete	unpatterned
97-1275	7n-8e	30-40	distal	unpatterned
97-1287	7n-8e	40-50	distal	atterned
97-1288	7n-8e	40-50	distal	unpatterned
97-1330	7n-8e	80-90	distal	patterned
97-1371	8s-8w	0-10	distal	patterned
97-1411	8s-8w	30-40	distal	unpatterned
97-1412	8s-8w	30-40	distal	patterned
97-1427	8s-8w	40-50	dis/prox	unpatterned
97-1451	8s-8w	60-70	distal	unpatterned
97-1479	8s-8w	80-90	dis/prox	patterned
97-1552	8s-8w	130-140	unidentifiable	unpatterned
97-1568	8s-8w	140-150	dis/prox	unpatterned
97-1569	8s-8w	140-150	midsection	unpatterned
97-1589	8s-8w	150-160	complete	unpatterned
97-1652	9n-14w	10-20	dis/prox	unpatterned
97-1653	9n-14w	10-20	dis/prox	unpatterned
97-1697	9n-14w	40-50	complete	unpatterned
97-1711	9n-14w	50-60	dis/prox	unpatterned
97-1741	9n-14w	70-80	distal	patterned
97-1742	9n-14w	70-80	dis/prox	unpatterned
97-1790	9n-14w	100-110	dis/prox	patterned
97-1791	9n-14w	100-110	complete	unpatterned
97-1792	9n-14w	100-110	dis/prox	patterned
97-1819	17s-12e	0-10	complete	unpatterned
97-1853	17s-12e	20-30	dis/prox	unpatterned
97-1877	17s-12e	40-50	complete	unpatterned

Type III- Thinning (percussion): This group of bifaces, predominately characterized by thinning and shaping of the artifact, is represented by 25 obsidian examples (95.8%) and one heat-treated ccs specimen (4.2%). Flaking patterns are often oblique in orientation as demonstrated by specimens 97-0231, -0261, -0753, -1077, -1287, and -1412. The ccs biface fragment is a recognizable distal element with a transverse break at its base.

Type IV- Final thinning (pressure): This biface stage represents final shaping of the artifact. Through pressure flaking activities, a regularized edge outline has been established. Eleven pieces (91.7%) of obsidian and one of ccs (8.3%) display this refined thinning technique. Two of these biface fragments are heavily serrated (97-0586, and -1741) and others (97-1451, -1411, and -1275) may, in fact, be fragments of projectile points. Every specimen in this stage exhibits patterned flaking in an often parallel fashion.

Type V- On a flake: Two obsidian bifaces (visually sourced: 97-1877 = GF/LIW/RS, 97-845 = Tuscan), differing from all others, have been fashioned from flake blanks. Their oblique and parallel-flaked surfaces do not obscure the original detachment scar of the biface. Plano-convex in cross-section, the margins show evidence of some pressure flaking although detachment scars on 97-1877 are not as extensive as on 97-845. Knife-like in form, the latter is the largest biface (length= 41.3 mm, width= 28.1 mm, thickness=4.8 mm, wt= 4.7 gm) in the Middle Mule Pond biface collection.

Table 16

Bifaces By Type and Raw Material

Type	Obsidian		CCS		Row Total	
	n	%	n	%	n	%
I	7	100.0	--	--	7	100
II	35	77.8	10	22.2	45	100
II	23	95.8	1	4.2	24	100
IV	11	91.7	1	8.3	12	100
V	2	100.0	--	--	2	100
TOTALS	78	86.7	12	13.3	90	100

Key: Type I = roughout
Type II = shaping
Type III= thinning
Type IV = pressure flaked
Type V = made from flake

Biface Discussion: The CA-SHA-1544 biface assemblage is dominated by obsidian (n=78, 86.7%; see Table 16). Obsidian bifaces are evident throughout the entire biface trajectory "Types". Technologically progressing from crude preforms to sinuously-edged, thin, symmetrical bifaces, this collection as a whole can be identified as intermediate stage reduction techniques.

The intensive debitage analysis from Unit 3S-8W demonstrates a near alignment with the overall biface collection. Much of the debitage is early to late core reduction (69.6% for combined obsidian and ccs materials) that may relate to the Type II (shaping) bifaces of obsidian and ccs (a combined total of 50%, n=45, of the biface collection). Unit 3S-8W does not, however, possess a high incidence of early to late bifacial thinning flakes relative to the Type III (thinning) bifaces (26.6%, n=26). Without further intensive debitage analysis of other units, and particularly those that may have been able to retain small pressure flakes (1/8" screens)(see above: Intensive Debitage Analysis), a full understanding of the core/preform/product sequence is not possible at this time. It can be suggested that most bifaces of obsidian, especially those of Tuscan, were split, roughed out, and initially shaped at the site.

Drills (Figure 15):

> Drills and drill bits generally possess long, narrow tips with double-keeled cross-sections, and ethnographic accounts and use-wear evidence indicate that they were used in a reciprocal twisting motion... (Farber 1987:6).

Three bifacial artifacts (97-0235, -0036, and -1370) have been classified as drills (Table 17). Extensive reworking and/or shaping of a "bit" are characteristic of these pieces. Two (97-0235, and -1370) of the three drills have been visually sourced as Tuscan obsidian; the other is a fine-grained volcanic material (97-0036).

Specimen 97-0235 is of a form generally referred to as a "winged drill" and is made from mottled gray-black (Tuscan?) obsidian. Highly suggestive of a Gunther point, the artifact appears to have been reworked into its present drill form from a projectile point. One tang is missing.

In the Fay Hill report two specimens, one listed as "Gunther" (#70-712) and the other as "winged drill" (#70-371), resemble this specimen from Middle Mule Pond (Farber and Neunschwander 1984:39, 59). It can be noted, however, that the CA-Sha-1544 specimen has more definitive tangs and what appears to be a sharper mid-line and point tip than the other specimens listed above.

Clewett and Sundahl record several groupings of drills from the Eagle Court site (1981:53). The Middle Mule Pond Site Mule Pond artifact is most closely related to their first descriptive group. The authors also note the following: “ [these drills] have the appearance of having been Gunther barbed projectile points which were subsequently thinned toward the tip leaving the barbs as ‘wings’ curving out to the sides away from the tip ends” (1981:53). The Eagle Court drills are also comparable to this non-provenienced Middle Mule Pond artifact in length, width, thickness and weight. It was also noted by Clewett and Sundahl that this drill type was found stratigraphically lower (72 cm) than other drill types.

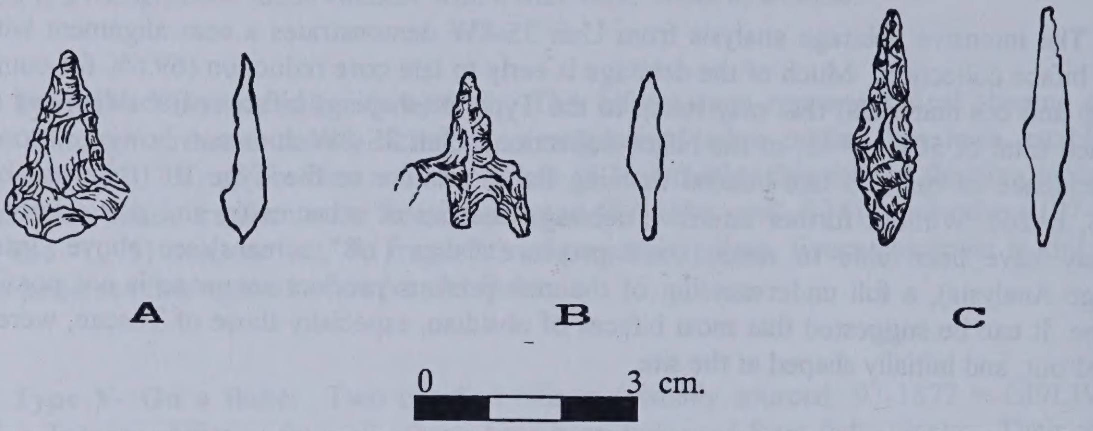


Figure 15. Drills; A) 97-1370, B) 97-235, C) 97-36.

The second artifact (97-0036) resembles the "third group" from the Eagle Court Site (Clewett and Sundahl 1981: 53-54). Made of basalt, it is highly polished and glazed in appearance. The handles or base broadens slightly overall, and its shape is cylindrical. The weights for Eagle Court drills (group 3) are 1.5- 2.3 gm, yet 97-36 from Middle Mule Pond weighs substantially less (1.0 gm). A search through local site report data within close proximity to CA-SHA-1544 reveals no other drills that appear to be this small by weight. This specimen's weight, however, may be attributable to the low density of its' unusually fine-grained material.

The final drill (97-1370), made of obsidian, is the only provenienced drill of the collection (8S-8W, 0-10 cm). Visually sourced as Tuscan glass, the bit has been modified to display pressure-flaked scars as well as ground and abraded areas. Although this wide-based specimen may have been hand-held in its terminal function, this drill may, in fact, represent a projectile point that was broken and/or reduced while still in the arrow shaft.

TABLE 17
Selected Drill Attributes

		Total Metrics/mm				Bit Only/mm		
Catalog #	Unit Level	Length	Width	Thickness	Weight	Length	Width	Thick
97-0036	vandal/bkdrt	30.5	8.4	4.9	1.0	16.6	6.1	4.1
97-0235	vandal/bkdrt	20.1	17.2	3.4	0.6	10.7	5.9	2.9
97-1370	8S-8W/0-10	24.5	16.0	4.6	1.2	14.9	9.8	3.8

Projectile Points

Projectile points are defined in this report as bifacially flaked stone artifacts, pointed on one end and containing a hafting element on the opposite end. Those recovered from the Middle Mule Pond Site were morphologically divided into categories based on metric attributes defined by Thomas (1970, 1981). The following morphological characterizations employ metric attributes and variables detailed in the descriptive statistics found in Appendix F.

A total of 110 projectile points (n=104 obsidian [Tuscan and GF/LIW/RS], n=6 chert) were recovered from CA-SHA-1544, including both provenienced and non-provenienced specimens. Most of these specimens are of the "Gunther Series" type designation (n=64, 58.2%), although four other projectile point categories are represented (see Table 18). The five untypable projectile point fragments are all of obsidian. Three of the latter artifacts are basal elements that exhibit transverse breaks. The other two fragments are comprised of portions of the base and blade. One of the latter specimens (97-742) also displays cortex on its mid-line indicative of the reduction of a Tuscan obsidian nodule.

Gunther Series (Figure 16): This point type, the most common within the Middle Mule Pond site, was originally named Gunther-barbed and described by Treganza as follows, “Basically the form is triangular. It has a definite stem of variant forms and has characteristic long barbs or tangs, the result of basal notching” (1958:14,15). Since long barbs are found in a minority of points of this general style, the designation Gunther Series is more commonly used to incorporate small stemmed points with barbs of varying length. Johnson and Skjelstad preferred to restrict the "Gunther-barbed" designation to those "...projectile points characterized by well-developed tangs which are often as long or longer than the stem" (1974:16). Sundahl (1982:172), on the other hand, suggests that varying attributes may be encompassed within the "Gunther" category, each having a limited temporal span based predominantly on stem morphology (contracting/tapering, parallel/straight, or expanding stems).

TABLE 18
Frequencies of Projectile Point Types

Point Type	Total Number	Percentage of Total
Gunther Series	64	58.2
Stemmed	5	4.5
(Small)	(2)	(1.8)
(Wide)	(3)	(2.7)
Cottonwood Triangular	2	1.9
Side-Notched	11	10.0
Corner-Notched	23	20.9
Untypable	5	4.5
TOTALS	110	100.0

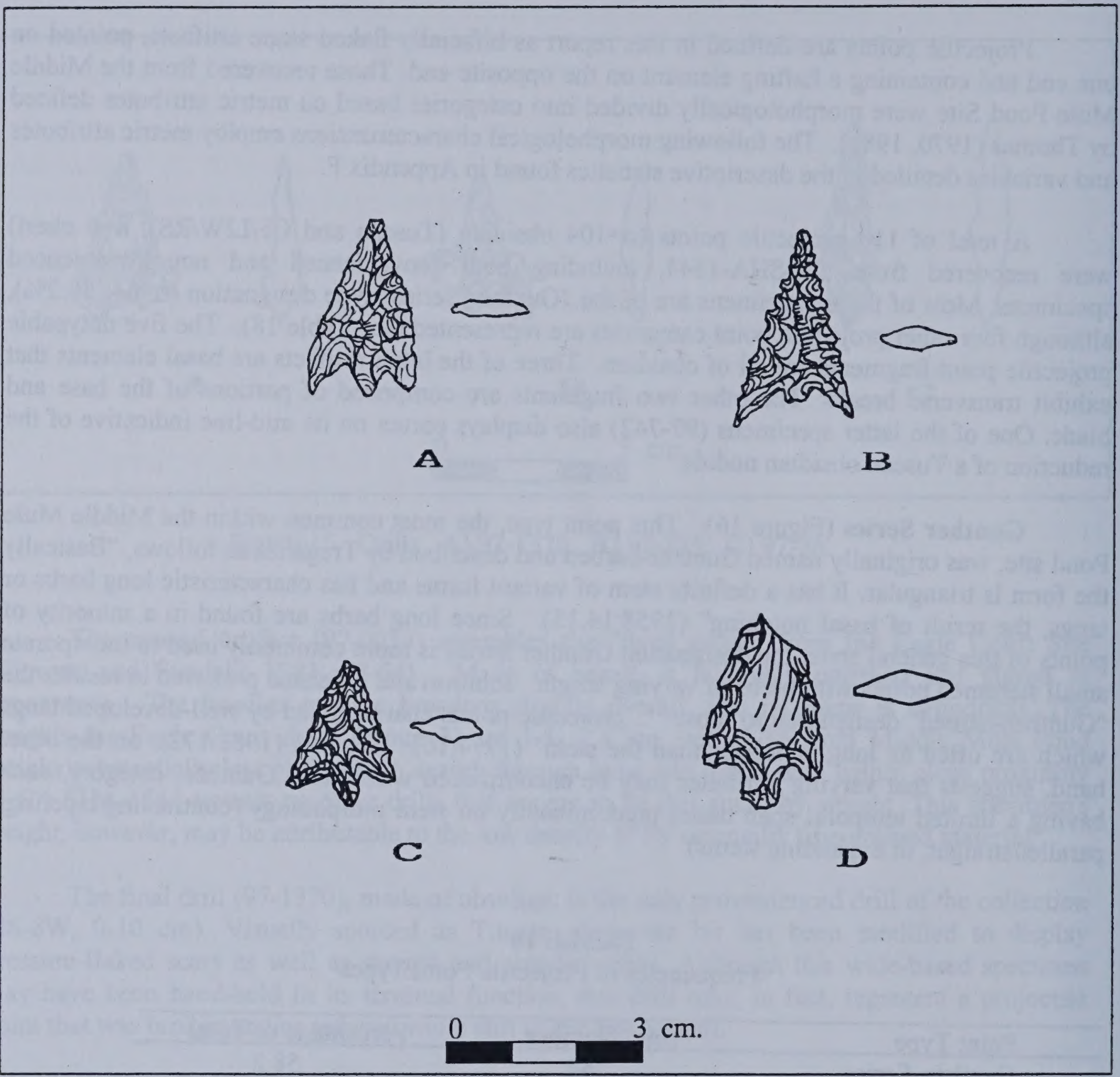


Figure 16. Gunther Series Projectile Points; A) 97-1520, B) 97-234, C) 97-1257, D) 97-679.

TABLE 19

Summary Metrics for Gunther Series Projectile Points

Attribute	Range mm/gm/degrees	Mean mm/gm/degrees	S.D.
Maximal Length	12.0-29.0	17.6	3.69
Axial Length	12.0-29.0	17.3	3.69
Maximum Width	11.0-22.0	14.8	2.43
Thickness	2.0-6.0	3.2	0.86
Weight	0.3-1.9	0.7	0.38
Basal Width	1.0-7.0	1.6	1.24
Neck Width	2.0-8.0	4.8	1.19
Proximal Shoulder Angle	50-100	61	11.03
Distal Shoulder Angle	115-175	135	13.81
Notch-Opening Angle	40-105	61	18.10
Base-to-Width Ratio		0.1	

The dominant point form from the Middle Mule Pond site is decidedly the Gunther Series projectile point. As with other late prehistoric sites in the Redding area (CA-SHA-782 near Pine Grove [Farber et al. 1985], and CA-SHA-266 at Eagle Court [Clewett and Sundahl 1981]) there is considerable variability among these small-stemmed point forms with respect to attributes of stem shape, tang size and shape, blade outline, and presence or absence of serrations.

Descriptive statistics for Gunther Series points at CA-SHA-1544 are summarized in Table 19. Although morphologically associated with other Gunther points, the table includes three specimens (97-0441, -0679, and -0896) that are generally wider, thicker, and also exhibit a greater basal width than other Middle Mule Pond Gunther Series points (see Figure 16D). Metrically subsuming these larger points into the Gunther Series classification allows Middle Mule Pond specimens to accurately reflect other regionally interpreted metric data (see Basgall and Hildebrandt 1989:126,127; Bass et al. 1982:674-677; Kelly et al. 1987:178-181). However, the large hydration rims, and stratigraphically deeper placement of these thicker projectile points warrant particular mention of their distinctiveness.

Two stem variants, contracting and parallel/expanding stem points are represented in the collection (see Table 20). Dotta (1967:13) has suggested the wide, parallel-sided stem variant has been noted as occurring stratigraphically deeper than the contracting stem-forms. More recently, several others have attempted to compare and contrast significant morphological variation in regard to stem type (cf. Jensen 1980, Sundahl 1982, and Farber et al. 1985). After applying the t-ratio to test for significant differences at CA-SHA-782, Ritter, "...suggests no significance to the difference between the mean depths at which the (varying stem-type) points occur within the deposit" (in Farber et al. 1985:64). Intuitively, however, he sees what may be a tendency for this difference.

Provenienced points (Gunther Series points from other than the vandal backdirt) were used to test for possible correlations between the variable stem types in relation to their temporal span. All provenienced Gunther series points (n=27) at CA-SHA-1544 have a depth range of 0-150 cm (mean = 45-55 cm, with only five specimens appearing below the 70 cm level). The mean depth calculated separately for the two stem variants suggest virtually no stratigraphic differences (parallel/expanding stem = 35-45 cm; contracting stem = 36-46 cm). The paucity of parallel-stem specimens (n=3), however, may contribute to inaccurate assumptions based on the limited data.

It has been noted that there is a frequent occurrence of serrated edges on Gunther Series points associated with Shasta Complex sites (Clewett and Sundahl 1981:46). Other studies reveal points "...with serrations poorly defined or non-existent" (Sundahl and Clewett 1985:24) or serrations occurring less frequently than in Shasta Complex sites (Kelly et al. 1987:179). Serrated Gunther Series points (n=45, 70.3%) at CA-SHA-1544 generally correspond with serration statistics for other local sites (e.g. CA-SHA-266 [74%] and CA-SHA-222 [75%]; Sundahl 1982:39,107) associated with the Shasta Complex.

Understanding possible correlations between the functionality and/or cultural affinity of serrated tools is not possible at this time. Sampson's work at Nightfire Island suggests "serration tends to increase with time, but is never prevalent in any stratum" (1985:342). In contrast, the prevalent Middle Mule Pond serrated points are found nearly equally distributed throughout the strata.

Gunther Series points are believed to date within the past 1500 years in this area (Treganza 1958:33). Certain attributes, such as the straight-shouldered/ 90-degree angle variety, may predate long barbs (Jensen 1980:17-20). In addition, Sundahl limits certain other Gunther attributes, such as the contracting stem form, to a temporal span of the last 700 years (1982:172).

TABLE 20
Gunther Series By Stem Type

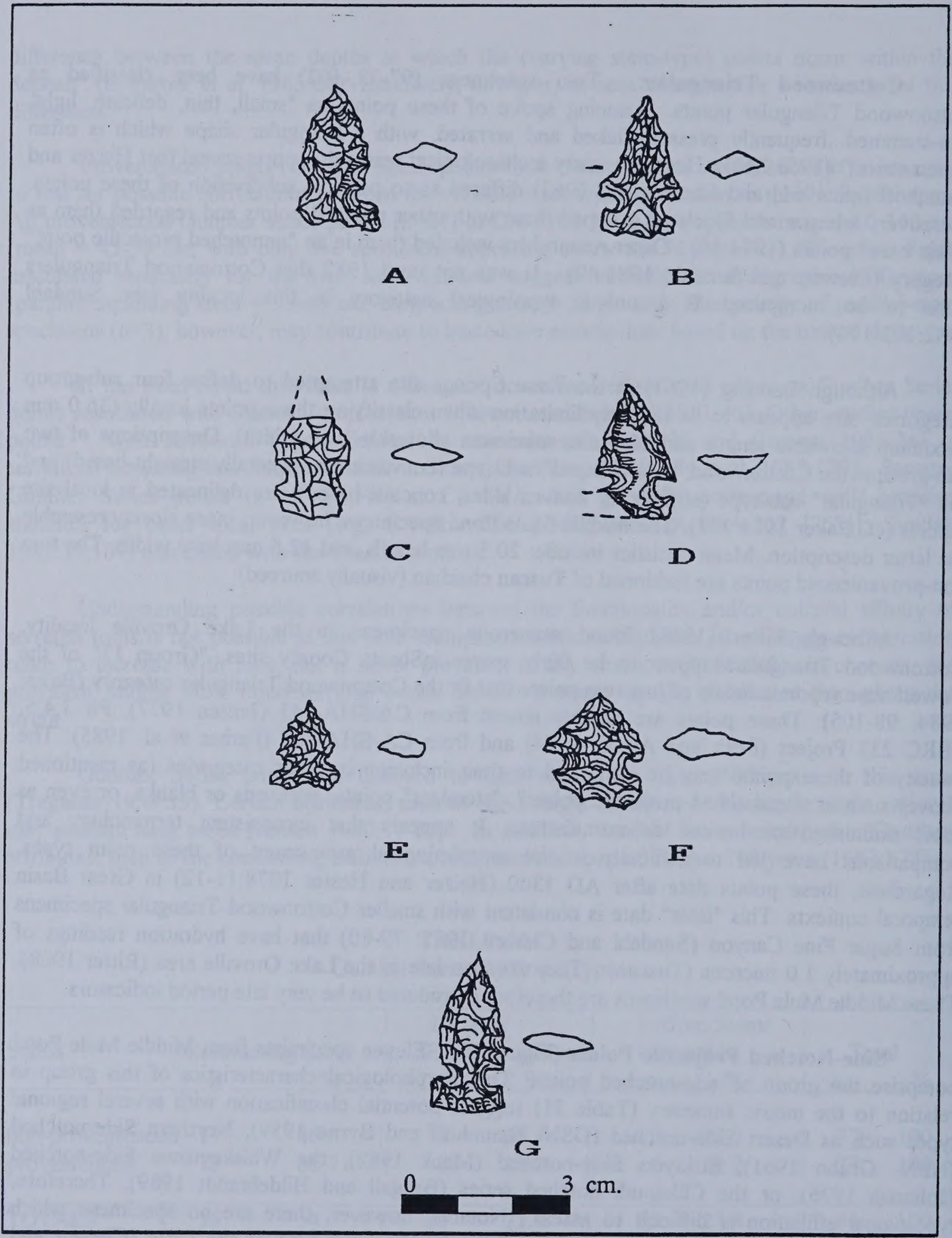
Status	Contracting Stem		Parallel/ Expanding Stem		Broken Stem/ Untypable		Total	
	n	%	n	%	n	%	n	%
non-provenienced	17	46.0	11	29.7	9	24.3	37	100
provenienced	18	66.7	3	11.1	6	22.2	27	100
TOTALS	35	54.7	14	21.9	15	23.4	64	100

Cottonwood Triangular: Two specimens (97-32,-102) have been classified as Cottonwood Triangular points. Lanning spoke of these points as "small, thin, delicate, light, non-stemmed...frequently pressure-flaked and serrated, with a triangular shape which is often asymmetrical" (1963:240). However, early archaeological research reports reveal that Heizer and Baumhoff (cf. 1961) and Lanning (cf. 1963) differed as to possible subdivision of these points. Moreover, Johnson and Skjelstad grouped these with other notched points and regarded them as "plain base" points (1974:16). Other researchers included them in an "unnotched projectile point" category (Clewett and Sundahl 1981:49). It was not until 1982 that Cottonwood Triangulars came to be recognized as a unique typological category in this locality (see Sundahl 1982:173-174).

Although Lanning (1963) at the Rose Springs site attempted to define four sub-group categories, size appears to be the only limitation when classifying these points locally (36.0 mm maximum allowable length and 22.0 mm maximum allowable base width). Descriptions of two sub-groups: the Cottonwood "Leaf-Shaped" sub-type (convex sides, generally straight-based) and the "Triangular" sub-type (straight or convex sides, concave-based), are delineated in local site reports (cf. Baker 1984:107). The Middle Mule Pond specimens, however, more closely resemble the latter description. Mean statistics include: 20.5 mm length, and 12.5 mm base width. The two non-provenienced points are fashioned of Tuscan obsidian (visually sourced).

Although Ritter (1968) found numerous specimens in the Lake Oroville locality, Cottonwood Triangulars appear to be fairly sparse inShasta County sites. "Group 13" of the Towerhouse report consists of just two points that fit the Cottonwood Triangular category (Baker 1984: 98-105). These points are notably absent from CA-SHA-543 (Jensen 1977), Pit 3,4,5, FERC 233 Project (Peak and Assoc. 1984) and from CA-SHA-783 (Farber et al. 1985). The paucity of these points may be attributed to their inclusion in other categories (as mentioned above) such as: "unnotched projectile points", "stemless" points, preforms or blanks, or even as tools unfinished or broken in manufacture. It appears that inconsistent terminology and comparisons have led to difficulty in the morphological assessment of these point types. Regardless, these points date after AD 1300 (Heizer and Hester 1978:11-12) in Great Basin temporal contexts. This "later" date is consistent with smaller Cottonwood Triangular specimens from Sugar Pine Canyon (Sundahl and Clewett 1985: 79-80) that have hydration readings of approximately 1.0 microns (Tuscan). They are also late in the Lake Oroville area (Ritter 1968). These Middle Mule Pond specimens are therefore considered to be very late period indicators.

Side-Notched Projectile Points (Figure 17): Eleven specimens from Middle Mule Pond comprise the group of side-notched points. The morphological characteristics of this group in relation to the metric summary (Table 21) suggest potential classification with several regional types such as Desert Side-notched (DSN- Baumhoff and Byrne 1959), Northern Side-notched (NSN- Gruhn 1961), Siskiyou Side-notched (Mack 1982), the Whiskeytown Side-notched (Johnson 1976), or the Clikapudi notched series (Basgall and Hildebrandt 1989). Therefore, typological affiliation is difficult to assess. (Notably, however, there are no specimens which display the deep "comma-shaped" notches of the Redding sub-type of the DSN [Clewett and Sundahl 1981:47]).


A
B
C
D
E
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G
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3 cm.

Figure 17. Side-Notched Projectile Points; A) 97-260, B) 97-28, C) 97-1160, D) 97-1727, E) 97-1834, F) 97-1331, G) 97-629.

TABLE 21
Summary Metrics for Side-Notched Projectile Points

Attribute	Range mm/gm/degrees	Mean mm/gm/degrees	S.D.
Maximal Length	16.0-28.0	21.5	3.75
Axial Length	15.0-28.0	20.9	3.69
Maximum Width	10.0-18.0	13.7	2.53
Thickness	1.0-5.0	3.3	1.05
Weight	0.2-1.5	0.8	0.35
Basal Width	8.0-18.0	12.7	2.66
Neck Width	6.0-11.0	8.0	1.41
Proximal Shoulder Angle	140-200	168	15.90
Distal Shoulder Angle	145-240	190	24.78
Notch-Opening Angle	10-80	35	23.92
Base-to-Width Ratio		0.9	

The point types mentioned above are problematic from a typological perspective in that size attributes (particularly length) and notch shape (and/or location of the notch) appear to be the determining factors in their taxonomic placement. It has been noted that this morphological variability "affects temporal designations which associate these points with some 4,000 years of use" (Nilsson et al. 1989:86)

The Middle Mule Pond specimens are small to intermediate in size (ML= 16.0-28.0 mm, mean= 21.5) and compare to the smaller side-notched points of the Sacramento River Canyon Project designated as either DSN's (PSA > 165 degrees) or Clikapudi side-notched variants (PSA > 150 degrees) (Basgall and Hildebrandt 1989:130-131,143-148). Of the three points recovered from depths of 0-20 cm (all other provenienced points [n=4] came from 50-140 cm) at Middle Mule Pond, only one (97-1834) may be morphologically classified as a general DSN.

All of these non-serrated points are of Tuscan (n=8, 72.7%) or GF/LIW/RS (n=3, 27.2%) obsidian (visually sourced). These specimens display straight (n=7), concave (n=3) or convex (n=1) bases. DSA's range from 145-240 degrees (mean = 190 degrees) and PSA's between 140-200 degrees (mean = 168 degrees). Two exhibit fine, parallel-flaked pressure flaking (97-0028,-0629) on elongated straight blade margins.

The DSN type may occur in late period contexts of post-AD 1500 (cf. Sundahl 1982; Sundahl and Clewett 1985), but in general, larger side-notched points are pre-Gunther in age (cf. Sundahl and Clewett 1985, Baker 1984). Basgall and Hildebrandt suggest that side-notched points co-occur with corner-notched points in the Sacramento River Canyon collection, grouped as the Clikapudi Notched series, dating between 3000-2000 years BP (1989:144).

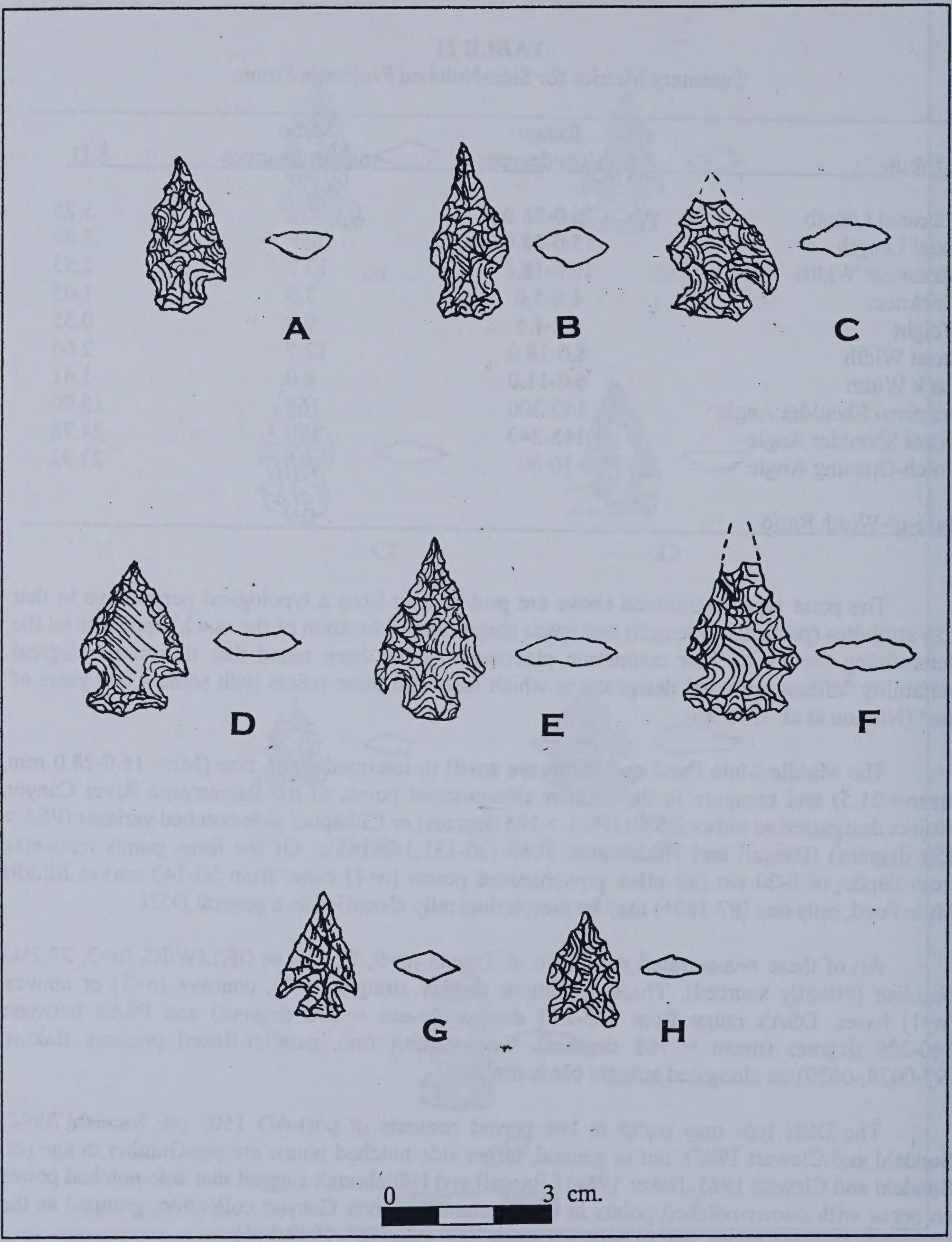

A
B
C
D
E
F
G
H
0
3 cm.

Figure 18. Corner-Notched Projectile Points; A) 97-228, B) 768, C) –691, D) -148, E) –822, F) –265, G) –814, H) –113.

Corner-Notched Projectile Points (Figures18): These points, considered "basically triangular in form, have notches directed diagonally upward from the corners" (Clewett and Sundahl 1982:36).

Twenty-three corner-notched points of obsidian (n=21) and chert (n=2) comprise the second largest group of projectile points from CA-SHA-1544. Although the points are generally dissimilar in form and appear to be the least consistent in terms of overall morphology, all maintain a broad base-to-width ratio (mean = 0.7)(refer to the Metric Summary, Table 22).

Many display little, if any, pressure flaking and often much of the original detachment scar is present. Most flaking is non-intrusive and does not approach nor form a central arris. Artifacts 97-0033 and -0269, both visually sourced as Tuscan glass, retain cortex on their blade or base respectively.

Two points (97-0768, and -1605) are fashioned of ccs. While both appear to have been thermally altered, specimen 97-0768 shows extensive reworking on the blade margins and tip as evidenced by intrusive flake scars nearing the mid-line and on exposed non-patinated areas.

Specimen 97-0814 (Figure 18G) displays a general resemblance to Rose Springs series points (cf. Thomas 1981). Not only have other researchers found it difficult to discriminate between the Rose Springs series and the expanding stem Gunther series (cf. Sundahl 1982, Kelly et al. 1987), some also find minimal distinction between Rose Springs and other corner-notched points (Nilsson 1989:87). This corner-notched point, however, was recovered from 9N-1E at 70-80 cm (hydration rim reading: 4.0 microns, visually sourced: Tuscan) and does not appear, because of the rim reading, to be contemporaneous with other Rose Springs/Gunther series points.

TABLE 22

Summary Metrics for Corner-Notched Projectile Points

Attribute	Range mm/gm/degrees	Mean mm/gm/degrees	S.D.
Maximal Length	13.0-32.0	23.1	4.67
Axial Length	12.0-32.0	22.9	4.94
Maximum Width	10.0-22.0	16.0	3.14
Thickness	2.0-8.0	4.9	1.31
Weight	0.4-2.9	1.5	0.74
Basal Width	6.0-17.0	11.6	2.51
Neck Width	5.0-12.0	9.0	1.93
Proximal Shoulder Angle	100-150	128.0	29.11
Distal Shoulder Angle	120-240	176.0	31.87
Notch-Opening Angle	5-110	50.0	30.29
Base-to-Width Ratio		0.7	

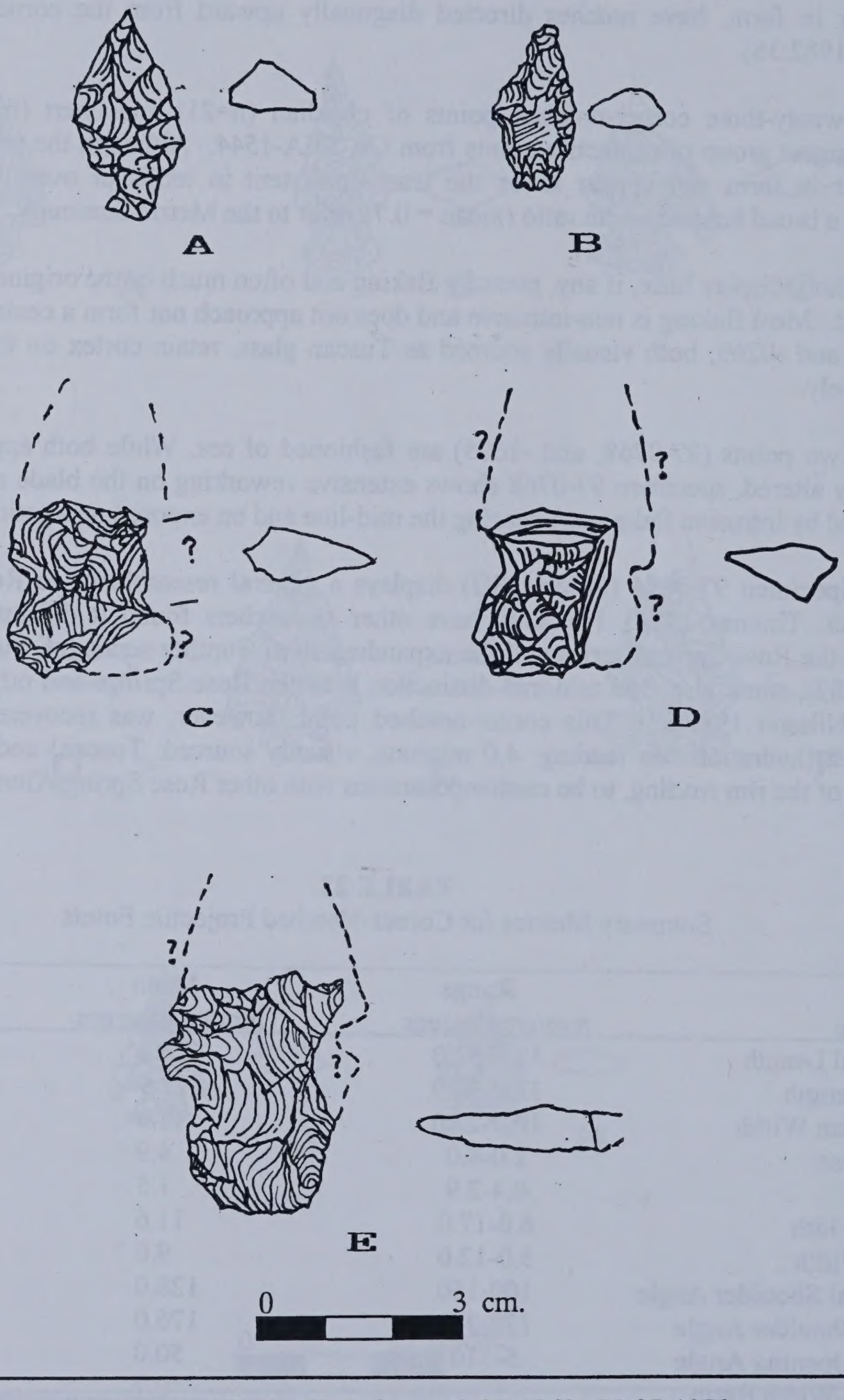


Figure 19. Stemmed Projectile Points; A) 97-1062, B) 97-1078, C)97-1754, D) 97-513, E) 97-516.

These regionally omnipresent, but variable, point forms have been recovered from many local sites including: CA-SHA-266 (Sundahl 1982), the Clikapudi sites (Clewett and Sundahl 1982), and CA-SHA-782 (Farber et al. 1985). Temporal contexts of these points are also variable. Smaller Sugar Pine Canyon corner-notched points occur in or near Gunther series contexts (Sundahl and Clewett 1985:77). Most often, however, these points usually appear as a pre-Gunther temporal marker (cf. Sundahl 1985). The general corner-notched form, incorporated within the Clikapudi Notched point series, is said to have

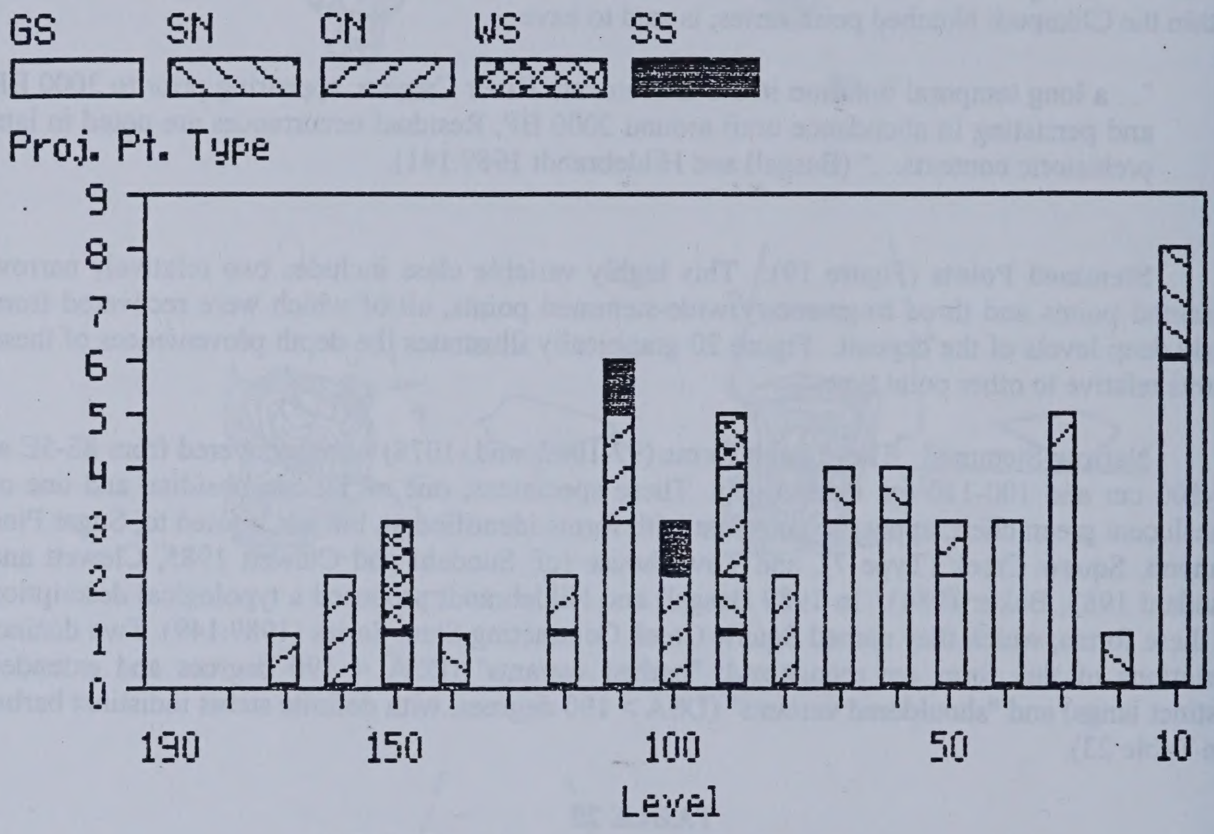
> "... a long temporal duration in the Sacramento River Canyon, appearing prior to 3000 BP and persisting in abundance until around 2000 BP. Residual occurrences are noted in late prehistoric contexts...." (Basgall and Hildebrandt 1989:141).

Stemmed Points (Figure 19): This highly variable class includes two relatively narrow stemmed points and three fragmentary wide-stemmed points, all of which were recovered from fairly deep levels of the deposit. Figure 20 graphically illustrates the depth proveniences of these points relative to other point types.

Narrow-Stemmed: These point forms (97-1062, and -1078) were recovered from 8S-5E at 90-100 cm and 100-110 cm respectively. These specimens, one of Tuscan obsidian and one of translucent green chert, appear to correlate with forms identified at, but not limited to, Sugar Pine Canyon, Squaw Creek (Type 7), and Towerhouse (cf. Sundahl and Clewett 1985, Clewett and Sundahl 1983, Baker 1984). In 1989 Basgall and Hildebrandt proposed a typological description of these forms, which they named Squaw Creek Contracting Stem Series (1989:149). Two distinct variations of this form are recognized: "barbed variants" (DSA < 190 degrees and extended distinct tangs) and "shouldered variants" (DSA > 190 degrees, with definite stems indistinct barbs; see Table 23).

TABLE 23
Summary Metrics for Narrow Stemmed Projectile Points

Attribute	Range mm/gm/degrees	Mean mm/gm/degrees	S.D.
Maximal Length	5.0-30.0	27.5	3.53
Axial Length	24.0-30.0	27.0	4.24
Maximum Width	12.0-16.0	14.0	2.82
Thickness	7.0-8.0	7.5	0.70
Weight	2.0-2.5	2.2	0.35
Basal Width	6.0-9.0	7.5	2.12
Neck Width	9.0-9.0	9.0	0.00
Proximal Shoulder Angle	80-105	93	17.67
Distal Shoulder Angle	225-240	233	10.60
Notch-Opening Angle	135-145	140	7.07



Key:

GS = Gunther Series
SN = Side-notched
CN = Corner-notched
WS = Wide-stemmed
SS = Small-stemmed

Figure 20. Projectile points plotted by depth and type.

Similar to the shouldered variant of the Sacramento River Canyon collection, these points show less extensive modification to their ventral surface. Both are plano-convex in cross-section with thick bases. Notably, the percussion-flaking which produced the minimally shaped notched areas on each point was obverse in orientation (removal directed only from the dorsal surface). Extensive retouch or reworking with pressure flaking is not evident on either of the specimens. A high central arris on 97-1062, however, may be a remnant indicator of an initially thicker artifact (see Basgall and Hildebrandt 1987:150).

These points were both found in association with Feature #5 (most possibly a burial). Specimen 97-1062, visually sourced as Tuscan glass, has a rim reading of 2.6 microns.

Obsidian hydration rim readings for large contracting stem points (GF/LIW/RS) from Squaw Creek indicate mean rates of about 4.8 microns. The points appear generally older than most other point types at the site (cf. Clewett and Sundahl 1983). The Sacramento River Canyon report suggests Squaw Creek Contracting Stem points at Sacramento River Canyon sites are "attributable to the earliest cultural phase" and note maximum overall GF/LIW/RS micron readings as 5.2 (Basgall and Hildebrandt 1987:160). Radiometric dating places these stemmed points at 3,000-5,000 years BP (Clewett and Sundahl 1983; Basgall and Hildebrandt 1989).

Wide-Stemmed: Three artifacts fashioned of ccs (brown and green Franciscan chert) (97-0513, -0516, and -1754) are thick, wide basal fragments of large wide-stemmed points. Group 5 of the Towerhouse report describes moderately large stemmed points which are heavily patinated, having blunted tip ends and evidencing considerable wear (Baker 1984: 102-103). Hildebrandt and Hayes have illustrated these points, termed Borax Wide-Stem, in Plate 6 of the Pilot Ridge study, and tentatively place them in the middle period of the regional sequence (1984:105). Large squared stem points (Type 11) from Squaw Creek are also believed to be affiliated with the Borax Lake Wide-Stem series (Clewett and Sundahl 1983:34-35). (Refer also to the large-stemmed series from CA-TRI-205 [Jensen and Farber 1982:137]).

All three Middle Mule Pond basal fragments are exceptionally thick in cross-section (mean = 9.0 mm). The largest specimen (97-0513) exhibits cortex on its extreme proximal end. This point also exhibits a perverse break just above what appears to be a double series of notches. From this one specimen alone, an estimate of 200 degrees for the DSA and 130 degrees for the PSA compares with that of the wide-stem group of the Sacramento River Canyon Project (Basgall and Hildebrandt 1989:177).

Local reports often characterize these point forms as "ancient" or as belonging to the earliest phases (cf. Clewett and Sundahl 1983, Sundahl and Clewett 1985). A few radiometrically related sequences indicate dates of about 6,500-7,500 BP (cf. Henn and Sundahl:1988). Sacramento River Canyon studies however, elicited dates (via hydration measurements), which demonstrate that wide-stemmed points co-occur with other corner- and side-notched points. Wide-stemmed points are still generally more prevalent in the earlier sequence (Basgall and Hildebrandt 1989:178).

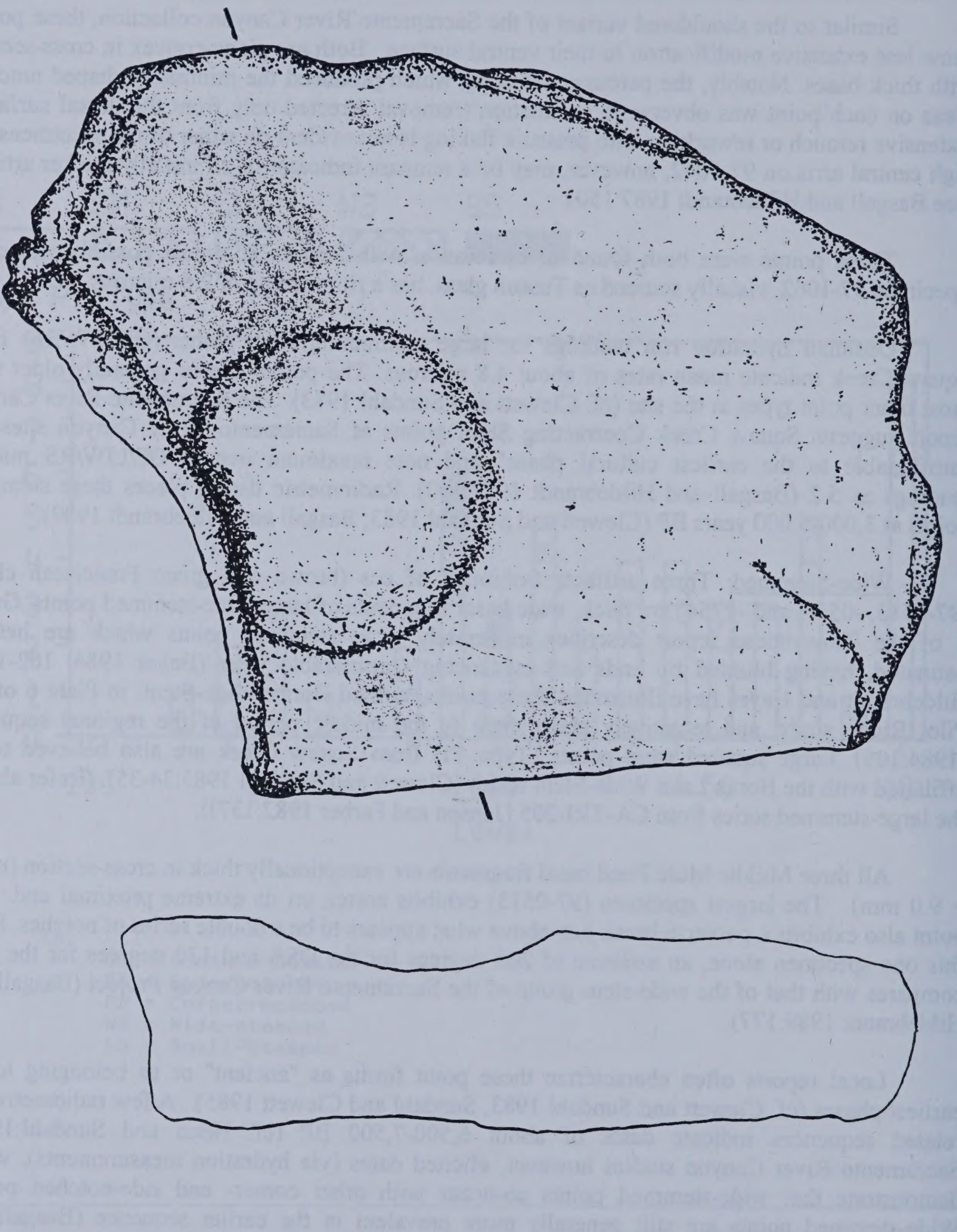


Figure 21. Hopper Mortar (97-1936).

Hopper Mortars (Figure 21)

Two hopper mortars (97-1936 and -1940) were recovered from depths of 60-70 cm and 140-150 cm, respectively (see Table 24 for depths of all groundstone artifacts). Both mortars are of medium-grained plutonic metavolcanic material, probably quartz diorite. The former measures 411mm by 323mm by 105mm in thickness and weighs 18.1kg. The latter is a fragment. These large, irregular-shaped blocks, both modified on one face only, exhibit depressions ranging from 110 to140mm in diameter and 9 to 17mm in depth.

Specific diagnostic information was not available for these hopper mortars with the exception that each mortar was found in the same level as a projectile point fashioned of obsidian (97-1936, side-notched point; 97-1940, Gunther series point). Although these points have not been subjected to hydration tests, visual sourcing indicates both obsidian specimens were derived from the Tuscan source.

TABLE 24
Groundstone Artifacts By Level

Level/cm	Hopper Mortar	Pestles	Milling-stones	Manos	Chisel/ Wedges	Hammer-stones	Anvils	Net Weight	Row Total
VandalBkdrt	--	3	--	2	2	5	--	--	12
Surface	--	2	1	1	--	--	--	--	4
0-10	--	--	--	--	--	1	--	--	1
10-20	--	--	--	--	--	--	--	--	--
20-30	--	1	--	--	--	--	--	1	2
30-40	--	--	--	--	--	--	--	--	--
40-50	--	--	--	1	--	--	--	--	1
50-60	--	--	--	2	--	1	--	--	3
60-70	1	1	--	--	--	1	--	--	3
70-80	--	--	--	--	--	1	1	--	2
80-90	--	--	--	--	2	--	--	--	2
90-100	--	--	2	1	1	--	--	--	4
100-110	--	--	1	--	--	1	--	--	2
110-120	--	--	--	--	--	--	1	--	1
120-130	--	--	--	2	--	1	1	--	4
130-140	--	--	1	1	--	1	--	--	3
140-150	1	--	--	--	--	--	--	--	1
150-160	--	--	--	--	--	--	--	--	--
160-170	--	--	--	--	--	--	--	--	--
170-180	--	--	--	1	--	--	--	--	1
180-190	--	--	--	--	--	--	--	--	--
TOTALS	2	7	5	11	5	12	3	1	46

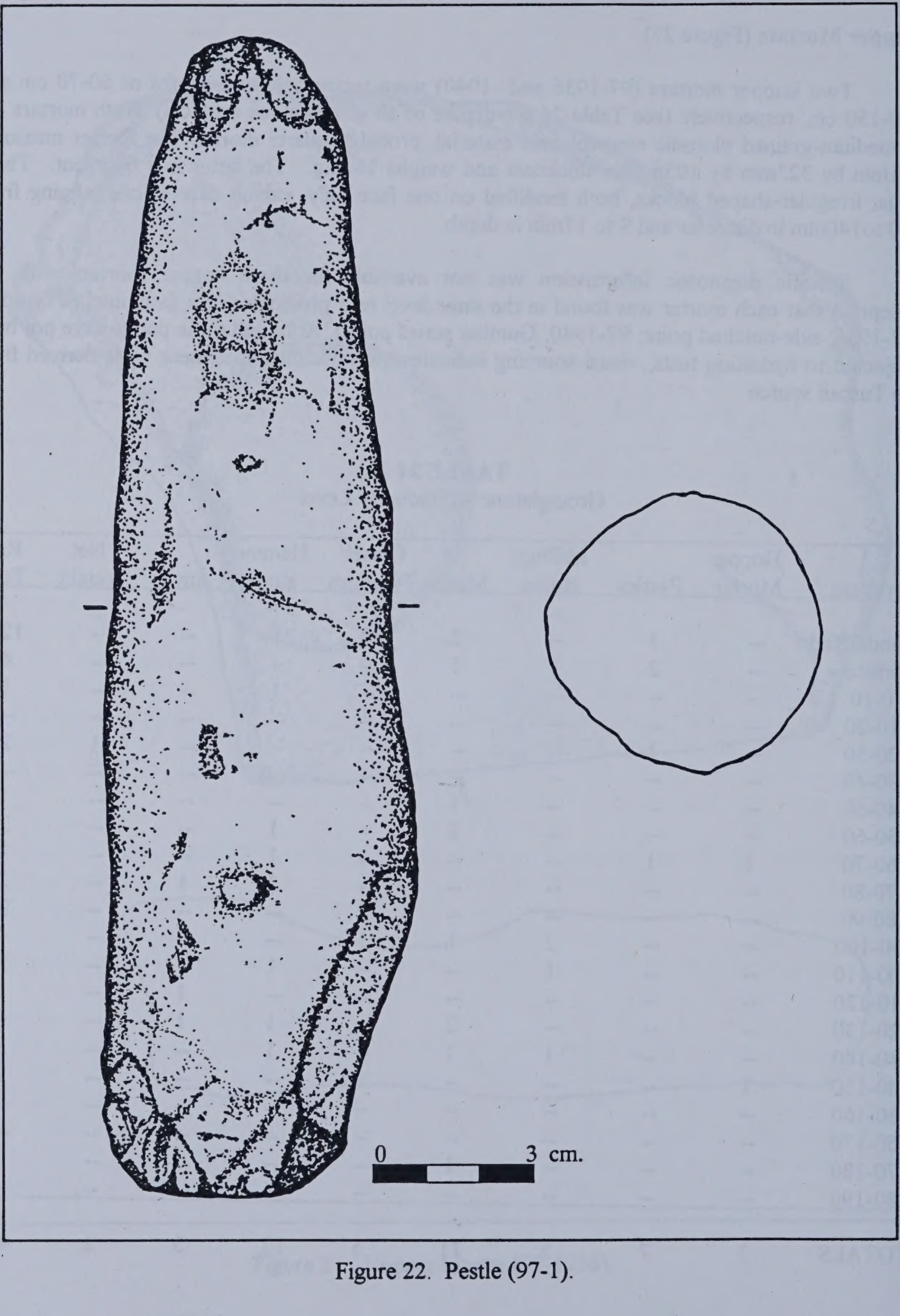


Figure 22. Pestle (97-1).

Pestles (Figure 22)

Seven specimens have been classified as pestles. Only two have vertical provenience as the other five were collected from vandal backdirt piles and the roadcut (see Table 25 for provience and dimensions). All are made of metavolcanic material.

Most of the pestles are conical in shape, often ovoid in cross-section and generally larger on one end than the other. Extant ends are often battered and flaked, which is most obvious on artifact 96-707 and the fragmented specimen 97-1221. Probable firing and dark staining is exhibited on specimens 97-181 and -240. The latter stains, dark red in color, may indicate the grinding of hematite for use as paint or other decorative or ritualistic use (DuBois 1935:126).

Artifact 97-326 of greenstone material is associated with human remains from Unit 3S-8W, 20-30cm. Staining is present near the battered, faceted ends.

Locally, similar pestles have been recorded for CA-SHA-992, the Hartnell Avenue Extension Project (Clewett and Sundahl 1982:27), although Middle Mule Pond specimens are comparatively smaller in size.

Table 25
Proveniences and Dimensions of Pestles
(dimensions in mm and weights in grams)

Cat. #	Unit	Depth	Length	Width	Thickness	Weight
97-1	vbkdirt	--	214.0	57.2	57.2	1100.0
-125	"	--	(62.0)	47.4	25.1	120.5
-181	roadcut	--	105.3	61.1	49.3	544.8
-240	vbkdirt	--	(78.4)	59.6	44.8	199.0
-326	3S-8W	20-30	196.0	58.8	56.6	1100.0
-707	roadcut	--	90.1	36.8	36.6	178.8
-1221	25S-12E	60-70	(110.1)	68.3	55.4	612.9

( ) broken specimen; figure represents fragmentary measurement
vbkdirt vandal backdirt

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Denver, CO 80225

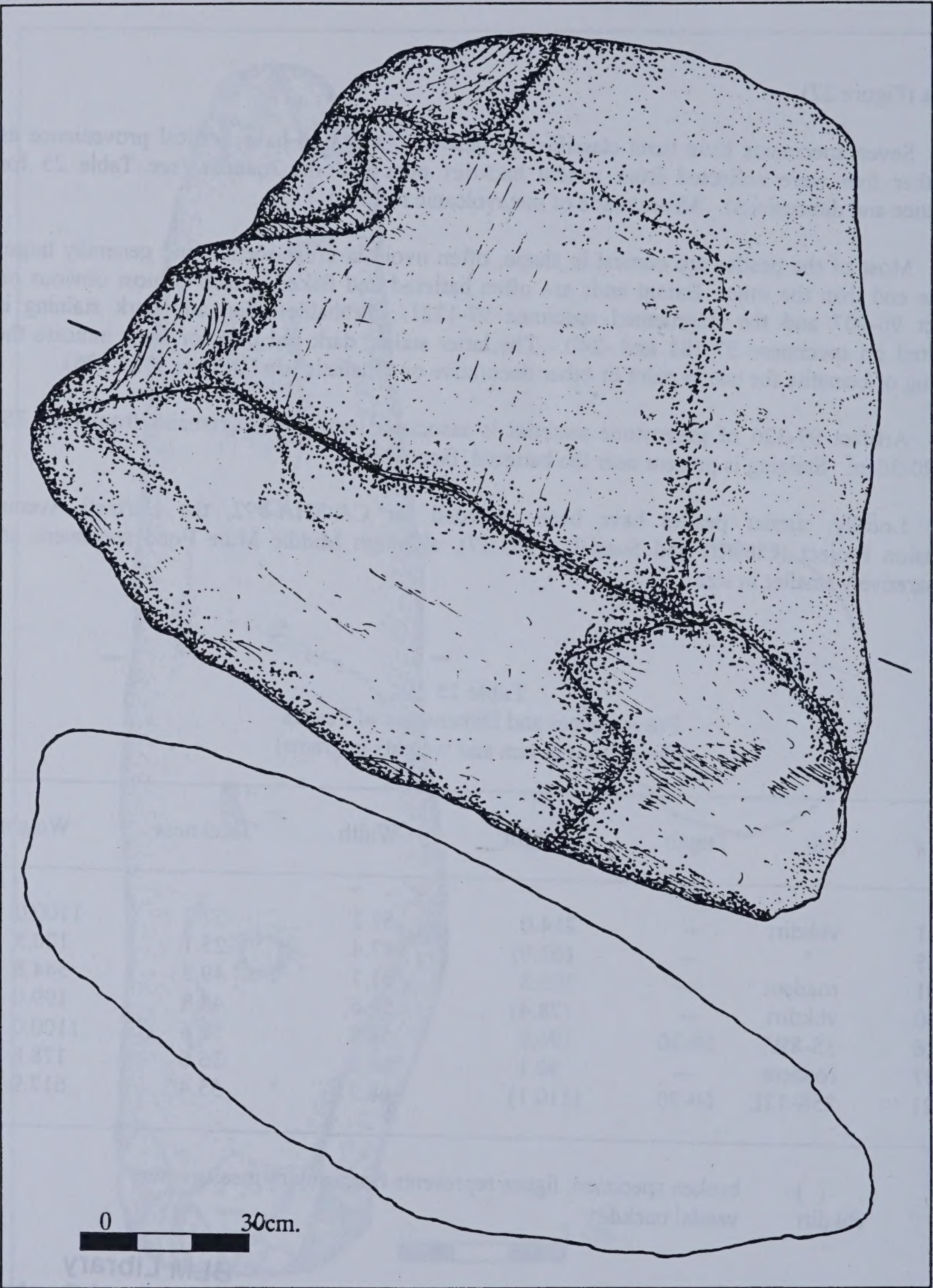


Figure 23. Millingstone (97-1943).

Millingstones (Figure 23)

Five unifacial, slab-like specimens exhibit a polished, centrally located, concave grinding facet. These large artifacts of meta-basalt, granite and greenstone materials are generally irregular in form with the exception of two fragments (97-1943 and -1944), which may have been oval or even circular in profile.

Dorsal surface depressions are very slight and no greater than 5mm in depth. Facets appear pecked (e.g. 97-1944), and often stained, possibly from cooking use (dark staining apparent on 97-273).

Clewett and Sundahl record similar specimens locally, noting that the central battering of these artifacts suggests that they were also used as hopper mortars. On one such artifact, "one surface shows a slight battering...but in depth it is too slight to measure" (1980:22).

Two fragments (97-1943 and 97-1946) appear to have been purposefully flaked or "pecked" to form an oval outline. This unifacial edge-modification by the removal of large flakes has also been recorded at Lake Britton, where they are termed "slab millingstones" (Kelly et al. 1987:215), and Sacramento River Canyon sites (Raven et al. 1984:87).

Millingstone diagnostic associatives at Middle Mule Pond include corner-notched points at 90-100 cm, Gunther series at 100-110 cm, and side-notched projectile points at 130-140 cm, the latter also co-occuring with a mano and hammerstone.

Table 26
Proveniences and Dimensions of Millingstones
(dimensions in mm and weights in kgs)

Cat. #	Unit	Depth/cm	Length	Width	Thickness	Weight
97-273	roadcut NW	--	264.0	219.0	77.0	7.2
-1942	3S-8W	90-100	289.0	175.0	102.0	6.2
-1943	8S-8W	130-140	210.0	(169.0)	70.7	2.4
-1944	9N-1E	90-100	190.0	(116.3)	59.6	2.1
-1946	3S-8W	100-110	(323.0)	204.0	113.0	10.2

( ) broken specimen; figure represents fragmentary measurement

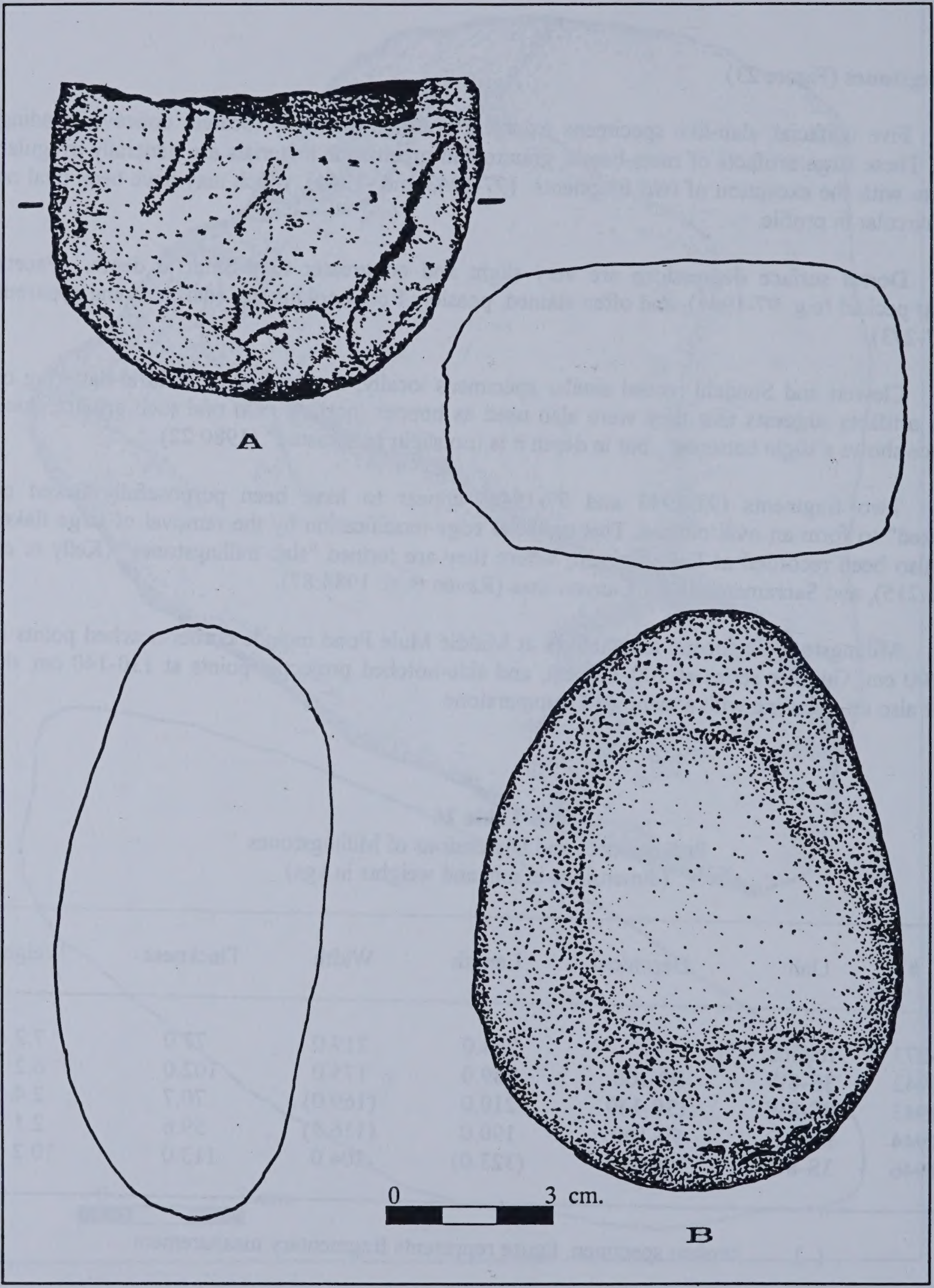


Figure 24. Manos; A) 97-631, B) 97-1555.

Manos (Figure 24)

Eleven manos (23.9% of the total groundstone collection) were collected from the looters' backdirt, the surface, and from depths of 40-180cm (Table 27). Although only three specimens are considered complete (97-25, -242, and -1555), two near-complete artifacts (97-883, and -1777) display areas of flake removal presumably due to end-battering or firing.

Medium to large-grained plutonic metavolcanic materials dominate the collection. Whereas most of the toolstone is compact and firm, item 97-25 alone is of badly decomposed and extremely pitty granitic material.

The manos are generally ovate with slightly rounded edges and ends. All display considerable polishing on their ground face, and are plano-convex (n=8) or bi-convex (n=3) in cross-section. Nearly all show slight end-battering, and the "pock-marks" of artifact 97-242 additionally contain a dark stain.

One mano fragment (97-1537) from the 120-130cm level of 8S-8W exhibits a centrally located "pecked region" (40mm in diameter, 2.5mm in depth) amidst a very smoothed and polished exterior face. This fragment may be related to an anvil-type tool (see:Anvils).

Provenienced manos (n=8) at Middle Mule Pond are most often (n=6, 75%) found in close association with diagnostic tools, other food processing implements, and/or human bone fragments or shell beads (refer to Table 28).

Table 27
Proveniences and Dimensions of Manos
(dimensions in mm and weights in grams)

Cat. #	Unit	Depth/cm	Length	Width	Thickness	Weight
97-25	vbkdirt	--	(105.9)	82.6	55.6	726.4
-242	"	--	92.9	68.2	39.3	299.2
-631	8S-11E	50-60	(52.1)	81.2	53.7	435.8
-710	5S-1W	surface	(86.3)	(84.0)	63.5	681.0
-883	9N-1E	120-130	117.8	97.2	(52.5)	1100.0
-1000	8S-5E	40-50	(34.0)	(53.6)	46.4	132.2
-1537	8S-8W	120-130	(59.8)	62.9	30.4	117.6
-1555	"	130-140	100.7	74.3	41.5	544.8
-1622	"	170-180	108.9	(47.0)	44.2	460.0
-1777	9N-8E	90-100	103.7	81.6	(41.4)	500.8
-1939	7N-8E	50-60	(81.8)	101.9	68.5	908.1

( ) broken specimen; figure represents fragmentary measurement

TABLE 28
Provenienced Mano Associations

Cat. No.	Unit	Level/cm	Artifacts recovered in close proximity to mano
97-100	8S-5E	40-50	Gunther pro. pt.(obs), shell bead
97-0631	8S-11E	50-60	SN pt.(obs),hydration value 2.5 microns visually sourced:Tuscan
97-1777	9N-14W	90-100	chisel/wedge
97-1537	8S-8W	120-130	hammerstone
97-1555	8S-8W	130-140	millingstone, hammerstone
97-1622	8S-8W	170-180	human bone fragments, shell bead

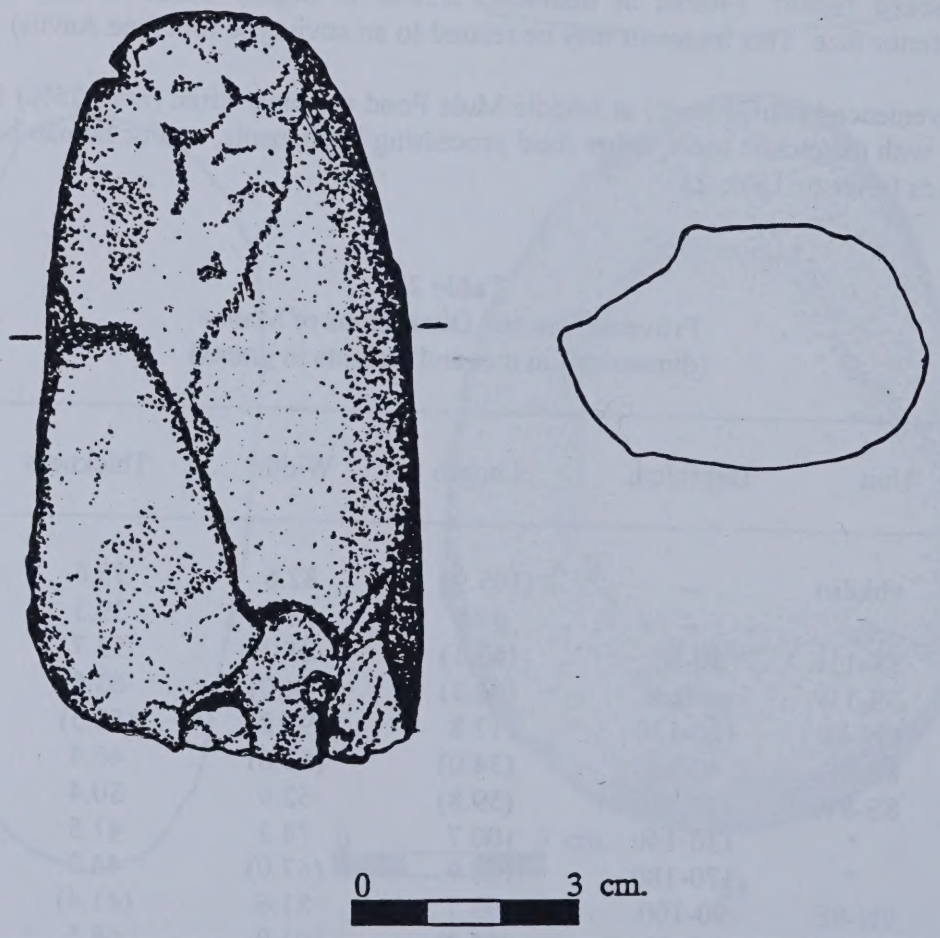


Figure 25. Chisel/Wedge (97-222).

Chisel/Wedges (Figure 25)

Five bi-plano (n=3) or plano-convex (n=2) artifacts are bifacially flaked on one end to form a transverse edge. This edge may exhibit some battering. The opposite, unflaked end is usually battered. One specimen (97-680) is longitudinally split. Uniformly unmodified with the exception of the ends, all appear to be formed of fine-grained metavolcanic (basalts and meta-basaltic) materials.

Irregular dark staining and unevenly blackened areas, suggestive of firing, are prominent on 97-126, and -222. Artifact 97-1045 is highly polished with battering exclusively on one end. It is uniquely associated with, or part of, a probable burial (see Feature #5, 8S-5E, 73-130cm) which also includes a hammerstone, shell beads, and two side-notched projectile points, one of which (97-1062), visually sourced as Tuscan obsidian, has a hydration rim of 2.6 microns,.

Locally, at CA-SHA-543, Jensen reports that these " . . . end of pestle fragments . . . have been so heavily battered, perhaps as a result of having served as hammerstones, that the grinding facets of the two end pieces are barely detectable" (1977:49). Baker also records unifacial "wedge-like cobble tools" which were "worked at one end to create a rather broad, thick, wedge-like edge" (1984:83).

Although these groundstone tools are described and typologically defined in a variety of ways, it is probable that some of these artifacts were originally pestles that were remodified into chisel/wedge-like tools (see Clewett and Sundahl 1981:68).

Table 29
Proveniences and Dimensions of Chisels/Wedges
(dimensions in mm and weights in grams)

Cat. #	Unit	Depth/cm	Length	Width	Thickness	Weight
97-126	vbkdirt	--	(96.4)	59.9	38.6	408.6
-222	"	--	101.0	52.6	36.0	248.1
-680	8S-11E	80-90	118.3	(36.3)	29.5	184.5
-1045	8S-5E	80-90	95.6	30.4	16.3	99.6
-1776	9N-14W	90-100	(55.1)	49.5	21.3	58.8

( ) broken specimen; figure represents fragmentary measurement

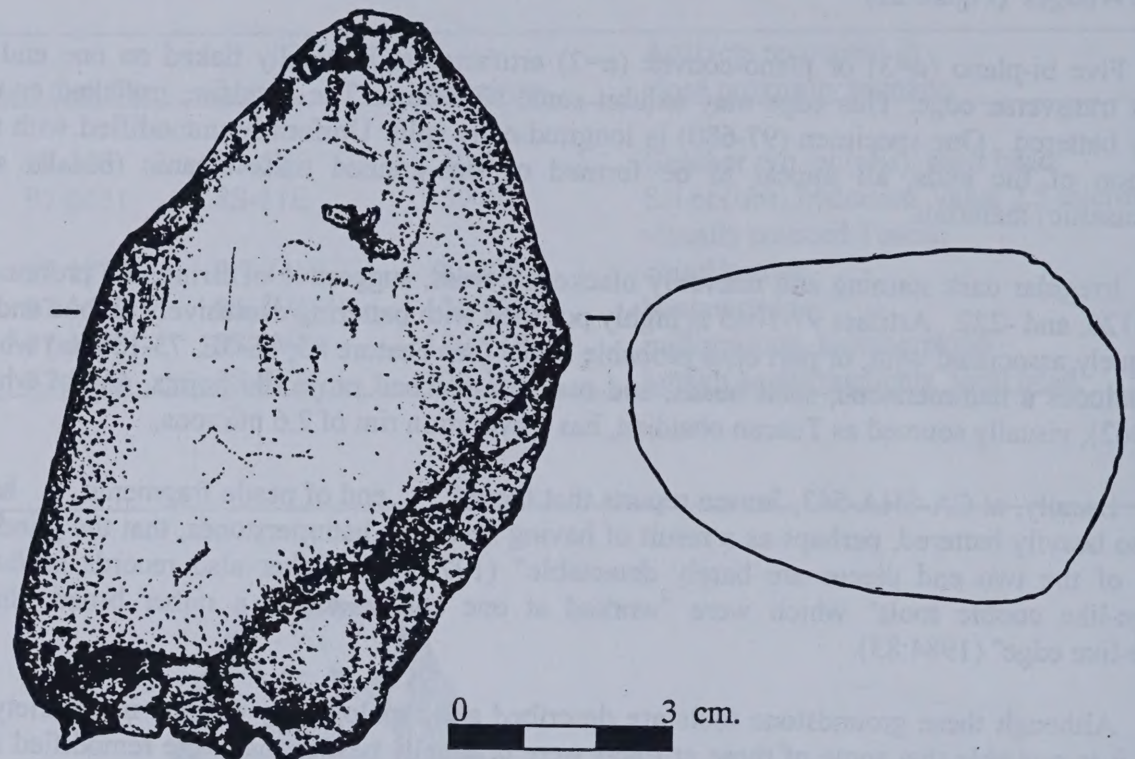


Figure 26. Hammerstone (97-221).

Hammerstones (Figure 26)

Twelve hammerstones were found throughout the deposit from the surface to a depth of 140 cm. (Table 30). Oval or ovoid in profile, materials include granitic-types, basalt, and andesite. Most probably derived from local stream cobbles, all exhibit slight (97-1088) to extensive (97-239) end-battering. Length range for Middle Mule Pond hammerstones are 55.5-136.7 mm with a mean of 86.8 mm.

One distinctive artifact, 97-1556, recovered from the 130-140 cm level of 8S-8W, displays striations running lengthwise on one face. These markings are similar to those that have been produced by the author experimentally when a hammerstone is "dragged" across the margin of flaked stone. This dragging or grinding strengthens the area of potential impact and prepares the platform of the flaked stone material.

DuBois (1935:127) mentions the use of oblong unshaped hammerstones by the Wintu, but does not specify how these hammerstones were used. Assumed to signify percussive use, these tools may have been utilized for, among other functions, flaked stone tool reduction.

Table 30
Proveniences and Dimensions of Hammerstones
(dimensions in mm and weights in grams)

Cat. #	Unit	Depth/cm	Length	Width	Thickness	Weight
97-183	vbkdirt NW	--	136.7	101.8	73.6	1400.0
-206	" SE	--	76.2	66.5	27.1	226.9
-209	" SE	--	82.1	37.6	27.4	123.9
-221	" SE	--	(108.0)	65.5	48.1	544.8
-239	" SE	--	64.9	45.4	34.2	136.1
-786	9N-1E	50-60	55.5	37.6	27.8	88.4
-1088	8S-5E	100-110	121.9	41.8	26.1	231.0
-1232	25S-12E	70-80	70.3	61.0	30.6	189.1
-1536	8S-8E	120-130	(75.1)	(55.4)	(35.7)	217.0
-1556	8S-8W	130-140	(58.5)	48.0	31.4	157.8
-1638	9N-14W	0-10	(48.0)	43.8)	(15.0)	55.2
-1899	17S-12E	60-70	(72.1)	55.3	46.0	216.4

Anvils (Figure 27)

Three specimens identified as anvils are of large-grained meta-basaltic materials. Predominately plano-convex in outline, the ovoid faces are polished and contain pecked depressions (mean 29mm in diameter, and maximum depth of 1mm). Ends are battered, similar to those of hammerstones, and dark staining is present (see Figure 27).

Table 31
Proveniences and Dimensions of Anvils
(dimensions in mm and weights in grams)

Cat. #	Unit	Depth/cm	Length	Width	Thickness	Weight
97-470	3S-8W	110-120	(92.1)	67.2	53.6	542.8
-490	3S-8W	120-130	143.1	103.9	54.0	1100.0
-1745	9N-14W	70-80	102.2	69.1	54.9	590.2

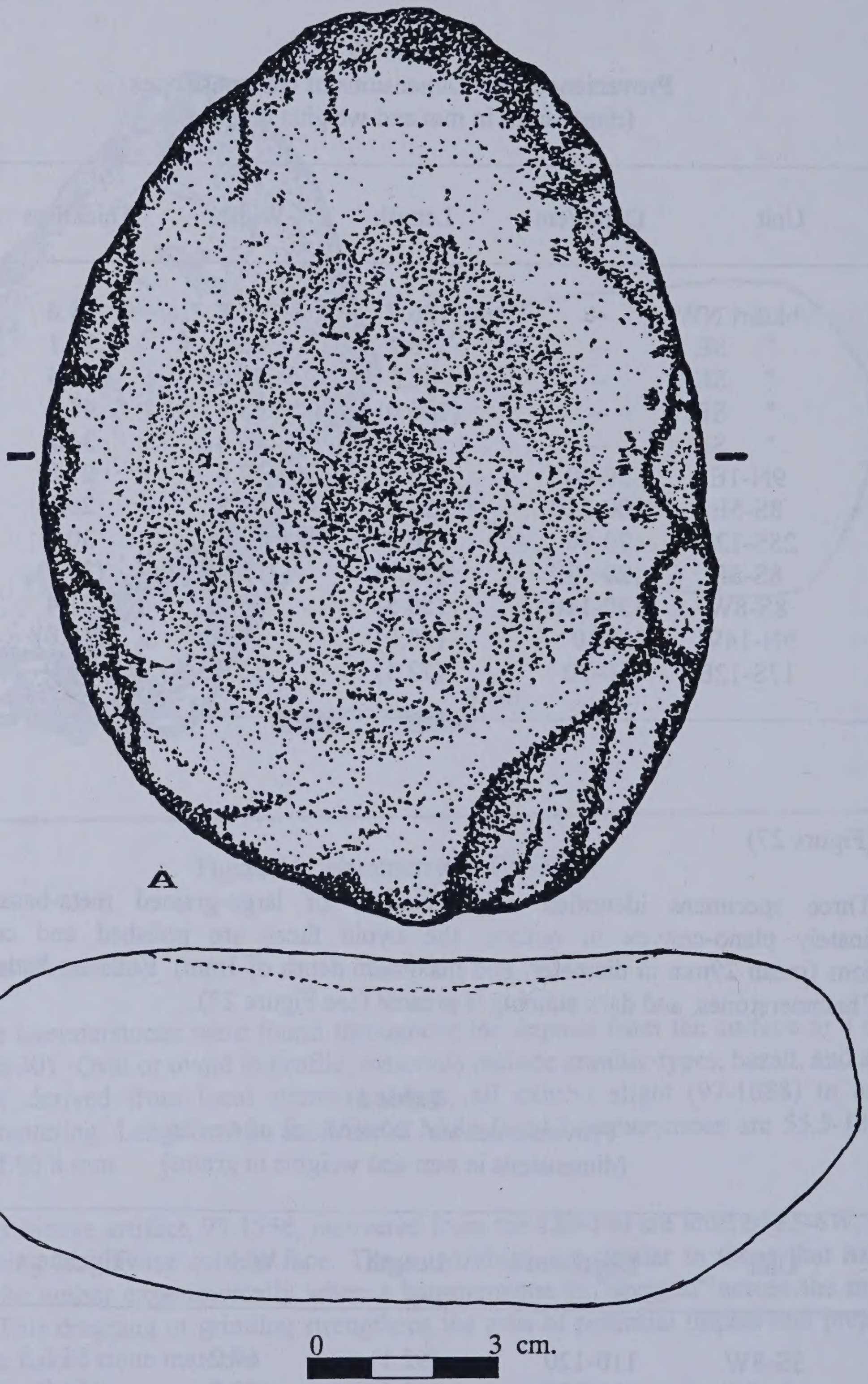


Figure 27. Anvil (97-490).

Similar anvils are also found at the Hartnell Avenue Extension Project ("large pear-shaped cobbles", Clewett and Sundahl 1982:29,30), Lake Britton (Kelly et al. 1987:218), and Squaw Creek (Clewett and Sundahl 1983:62).

Ethnographic data reported for the McCloud River Wintu (Voeglin 1942:74) and the Yana (Gifford and Klimek 1939:81) record the use of "acorn anvils" for the hulling, crushing and milling of acorns. Recently, however, questions concerning the function or multi-functions of these artifacts, in conjunction with localities of intensive obsidian reduction, suggest these anvils may have been utilized for the purpose of bipolar reduction, specifically for the splitting of Tuscan obsidian nodules. It is noted that, although these anvils are common in some regions, such as the southern Cascades, and absent in others like the middle Pit River collections, it has been suggested that "they are not necessarily associated with the use of acorns" (Johnson 1984:207-8, 274)).

Net Weight (Figure 28)

A single specimen, 97-979, recovered from the 20-30cm level of 8S-5E, has been identified as a net weight. It measures 60.3 mm in length, 51.5 mm in width, and 18.7 mm in thickness and weighs 87.8 grams. Its lateral margins have been minimally bifacially ground and flaked to produce notched indentations on either side of its mid-section. The medium-grained meta-basaltic material is similar to those material types for 27 artifacts that were designated net weights at CA-SHA-995, the Hartnell Avenue Extension Project (Clewett and Sundahl 1982:30-33). In addition, dimensional statistics for this specimen are nearly identical to the mean statistics of the Hartnell net weights.

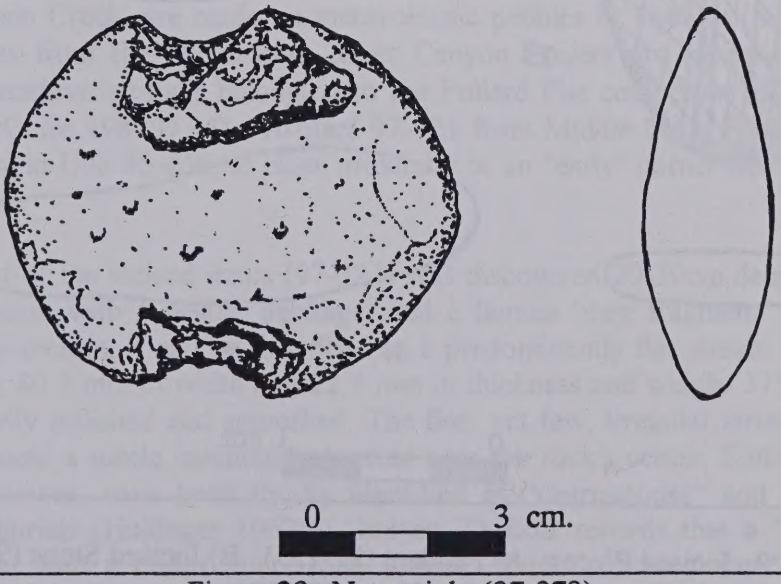


Figure 28. Net weight (97-979).

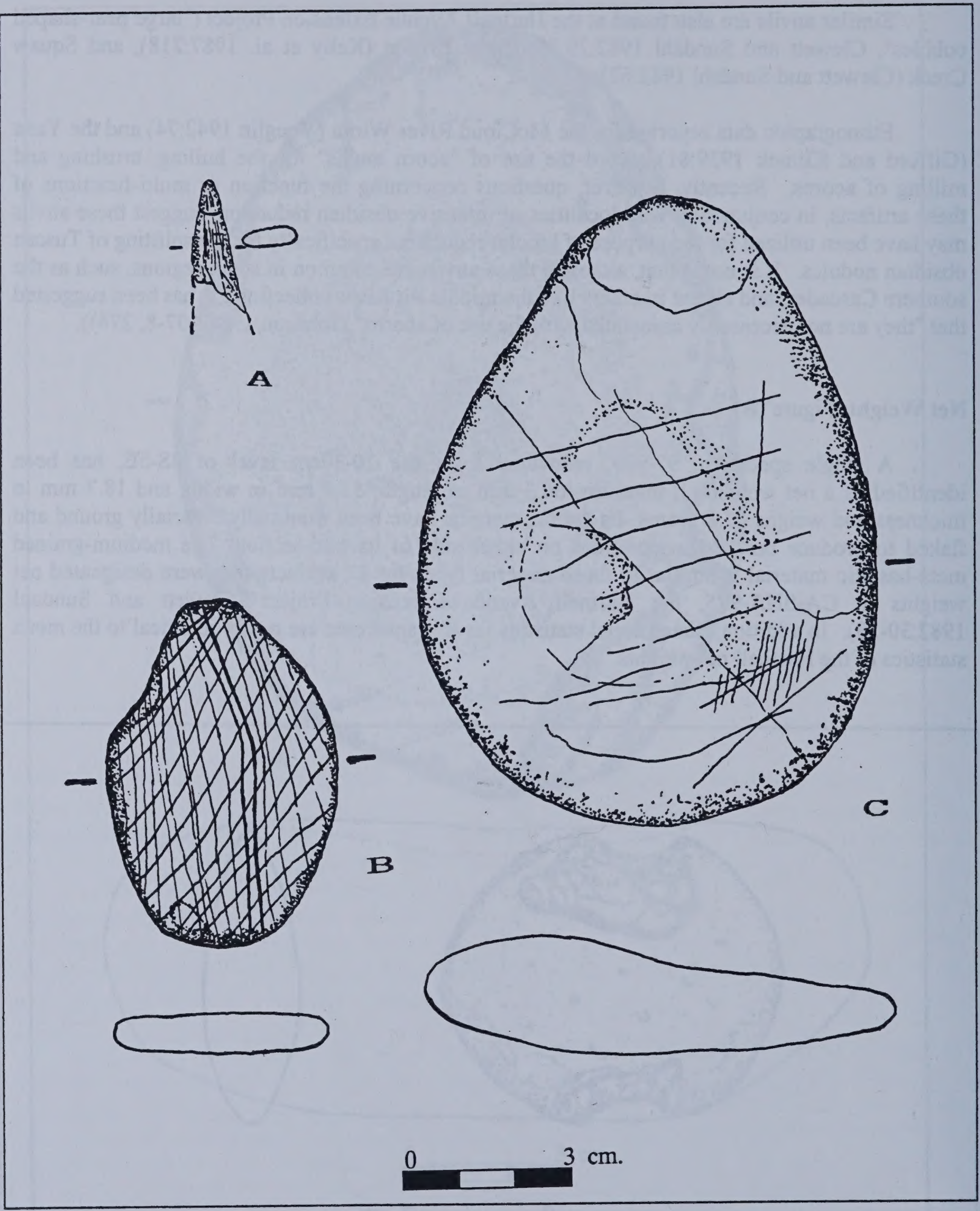


Figure 29. Incised Pieces; A) Pendant (97-155), B) Incised Stone (97-421), C) Sucker Charm (97-324).

Incised Stone Artifacts (Figure 29)

Three artifacts that are unrelated morphologically are grouped here typologically because each features an incised design. Two are fashioned of fine-grained basalt and one is steatite.

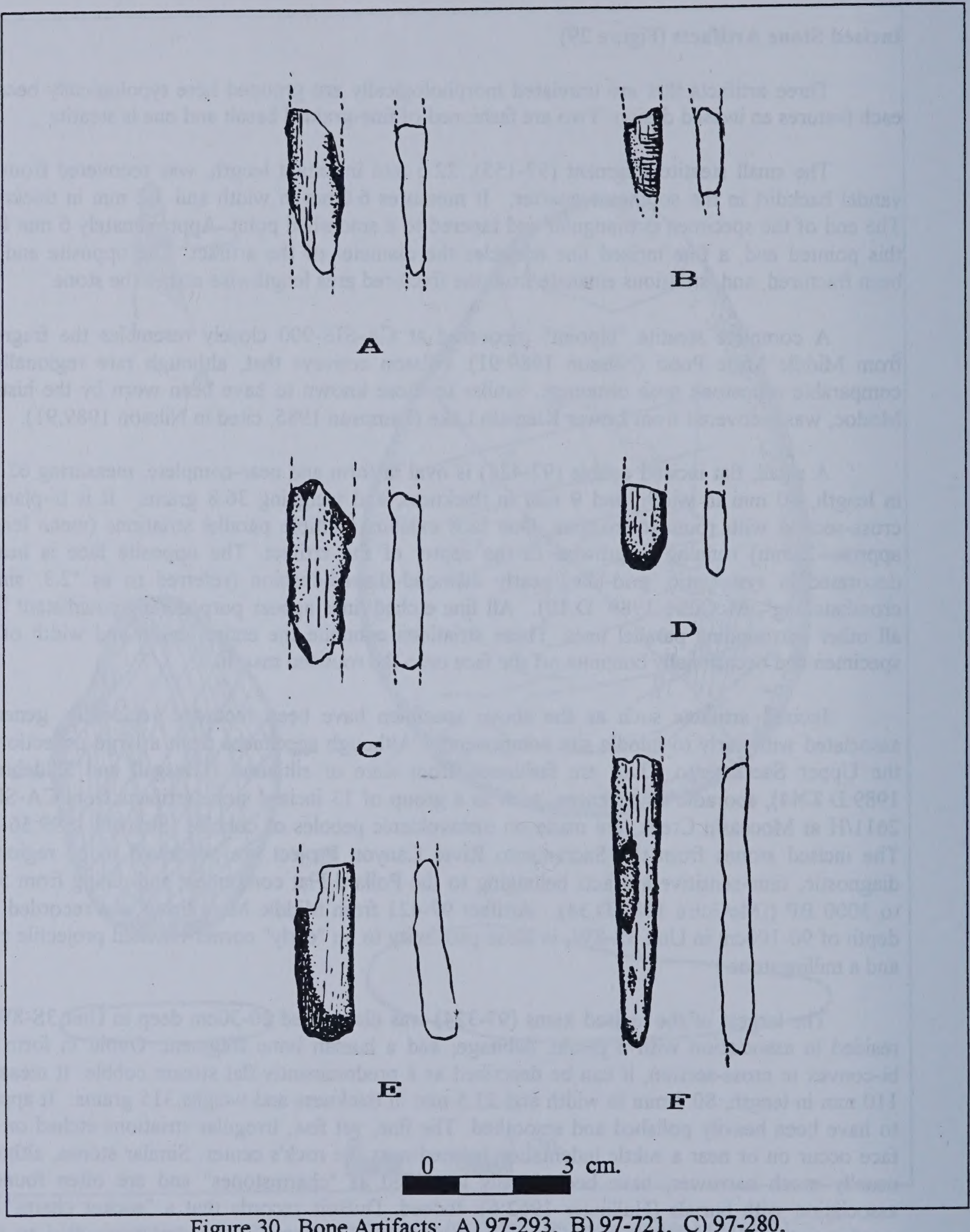
The small steatite fragment (97-155), 22.6 mm in extant length, was recovered from the vandal backdirt in the southeast quarter. It measures 6.8mm in width and 3.2 mm in thickness. The end of the specimen is triangular and tapered to a smoothed point. Approximately 6 mm from this pointed end, a fine incised line encircles the diameter of the artifact. The opposite end has been fractured, and, striations emanate from the fractured area lengthwise across the stone.

A complete steatite "bipoint" recovered at CA-SIS-900 closely resembles the fragment from Middle Mule Pond (Nilsson 1989:91). Nilsson conveys that, although rare regionally, a comparable soapstone nose ornament, similar to those known to have been worn by the historic Modoc, was recovered from Lower Klamath Lake (Sampson 1985, cited in Nilsson 1989:91).

A small, flat incised cobble (97-421) is oval in form and near-complete, measuring 62 mm in length, 40 mm in width, and 9 mm in thickness, and weighing 36.8 grams. It is bi-plano in cross-section with rounded margins. One face exhibits multiple parallel striations (mean length: approx. 25mm) running lengthwise in the center of the artifact. The opposite face is heavily decorated in systematic, grid-like, nearly diamond-shaped fashion (referred to as "2.3: simple crosshatching", McGuire 1989: D.10). All fine etched lines appear purposefully equidistant from all other surrounding parallel lines. These striations continue the entire length and width of the specimen and occasionally continue off the face onto the rounded margin.

Incised artifacts such as the above specimen have been recorded regionally, generally associated with early to middle site components. Although specimens from a large collection on the Upper Sacramento River are fashioned from slate or siltstone (Basgall and Hildebrandt 1989:D.1-44), sporadic occurrences, such as a group of 13 incised stone artifacts from CA-SHA-2611/H at Moccasin Creek, are made on metavolcanic pebbles or cobbles (Sundahl 1999:56-58). The incised stones from the Sacramento River Canyon Project are perceived to be regionally diagnostic, time-sensitive artifacts belonging to the Pollard Flat component and dating from 5000 to 3000 BP ([McGuire 1989:D.34). Artifact 97-421 from Middle Mule Pond was recorded at a depth of 90-100cm in Unit 3S-8W, in close proximity to an "early" corner-notched projectile point and a millingstone.

The largest of the incised items (97-324) was discovered 20-30cm deep in Unit 3S-8W. It resided in association with a pestle, debitage, and a human bone fragment. Ovoid in form and bi-convex in cross-section, it can be described as a predominantly flat stream cobble. It measures 110 mm in length, 80.7 mm in width and 22.5 mm in thickness and weighs 315 grams. It appears to have been heavily polished and smoothed. The fine, yet few, irregular striations etched on one face occur on or near a subtle indentation located near the rock's center. Similar stones, although usually much narrower, have been locally identified as "charmstones" and are often found in association with burials (Hullinger 1962:6). Indeed, DuBois records that a "sucker charm" is a nondescript pebble with a concavity on one surface. These sucker charms were said to have brought luck to fishermen (1935:82).


A
B
C
D
E
F
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3 cm.

Figure 30. Bone Artifacts; A) 97-293, B) 97-721, C) 97-280, D) 97-730, E) 97-1938, E) 97-754.

Bone Tools

Six bone tools recovered from CA-SHA-1544 were typologically classified by Eric Ritter. Principally consigned to the upper strata of the deposit, these tools are variable in size and shape. Proveniences and sizes are given in Table 32.

Flaker (Figure 30 A): Item 97-293 is a highly polished split canon bone of a deer. Gifford records the "Gouge, Smoother, or Flaking Tool" category as "solidity; most of them are short, relatively heavy . . .(the) rounded tip suggests abrasive use, rather than perforating" (1940:170). The rounded end of this specimen strongly resembles the description by Gifford.

Awls (Figures 30 B and F): Two fragments termed awls were both located in Unit 9N-1E (97-721, and -754). Gifford describes these as a "single-pointed-perforating implement" (1940:168). Specimen 97-754 is an elongated polished piece that tapers to one end. Artifact 97-721 is solely a tip element. It is here deemed an "awl tip" due to circumferential striations near the termination. The striations may be suggestive of awls utilized for making coiled basketry or for perforating skins (Gifford 1940:168).

Gaming Piece (Figure 30 E): A possible bone pin or gaming piece, this artifact (97-1938) is plano-convex in cross-section and burnt on its blunt termination. Artifact illustrations and descriptions from Gifford suggest that gaming pieces are of solid bone (1940:176). Heavy polishing on this specimen may indicate extensive handling.

Unidentifiable Tool Fragments (Figures 30 C and D): Two tools are unidentifiable (97-280, and -730). One is a calcined mid-section fragment of a split canon bone which has fine striations centrally located on the ventral surface. The second artifact (97-730) displays a rounded, blunt end termination. It shows evidence of burning, and could tentatively be designated decorative or ornamental in function.

TABLE 32

Proveniences and Dimensions of Bone Tools

Catalog #	Unit	Level	Length/mm	Width/mm	Thick/mm	Type
97-0280	v/bckdrt	SE	(31.2)	(10.4)	5.4	Unident.
97-0293	v/bckdrt	SE	(28.7)	(9.1)	5.4	Flaker
97-0721	9N1E	0-10	(14.5)	6.5	4.0	Awl tip
97-0730	9N1E	10-20	(14.6)	7.2	3.6	Unident?/ Ornamental?
97-0754	9N1E	30-40	(50.8)	(7.0)	4.8	Awl
97-1938	8S8W	3 0-40	(30.0)	(9.4)	5.5	Gaming Piece

( ) = extant measurements

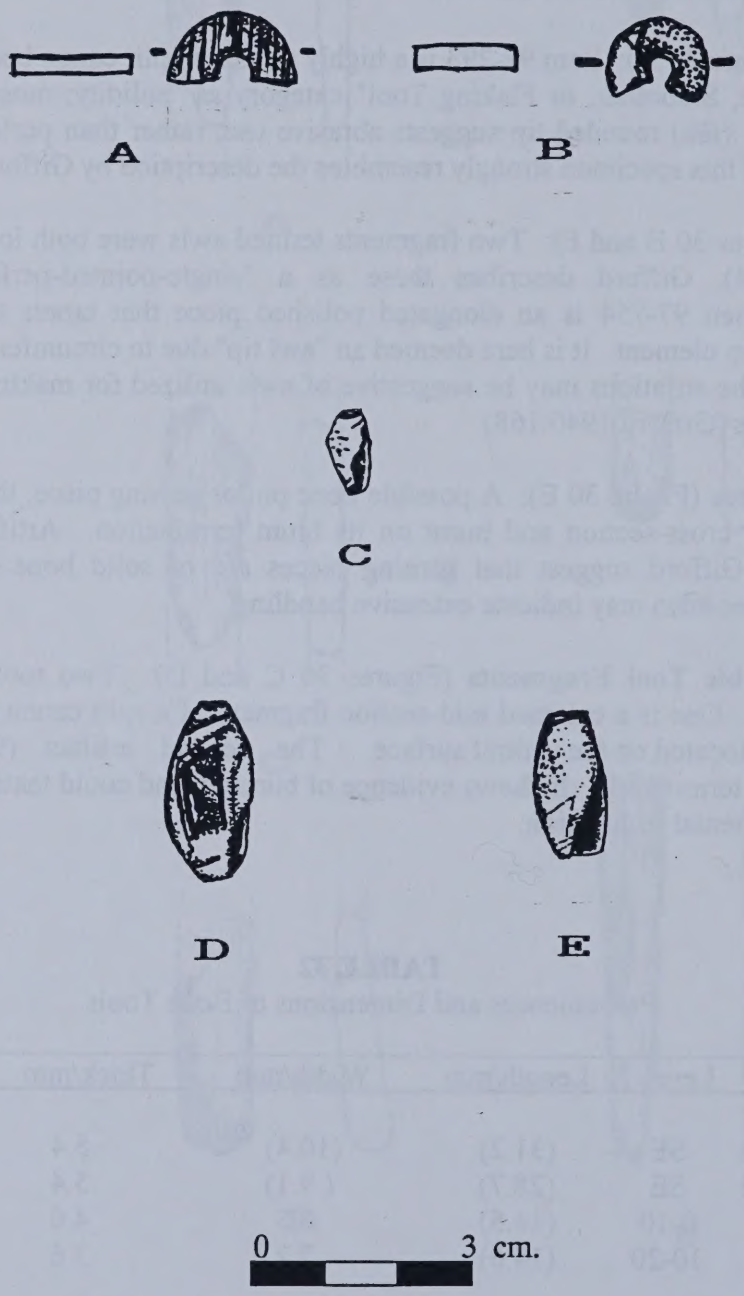


Figure 31. Shell Beads; A) 97-1067, B) 97-1003, C) 97-1621,
D) 97-355, E) 97-1608.

Shell Artifacts (Figure 31)

Eighteen specimens were identified as marine shell artifacts during an analysis of shell conducted by Susan Eugster. Table 33 lists the artifacts by description and provenience. Among them, six *Olivella* shells or shell fragments are associated with Feature 5 in Unit 8S-5E that also contained human teeth and bark slabs. *Olivella* shells were also recovered from Units 8S-8W and 3S-8W (Figure 32 C-E).

Other marine shell items include clam-shell disk beads (Figure 31 A-B) and two gastropod shells recorded in close proximity to the feature in 8S-5E. One final gastropoda was recovered from Unit 8S-8W at 100-110cm.

The marine shell may have served a prestige and/or status function (Bennyhoff and Hughes 1987). Most of the specimens were found in conjunction with human bone, teeth, and /or features.

Table 33
Proveniences of Marine Shell Artifacts

Cat. No.	Unit	Depth/cm	Number	Shell Type
97-244	Vandal/backdirt	---	1	clam-shell disk bead
-335	3S-8W	30-40cm	1	*Olivella* bead
-991a	8S-5E	30-40cm	1	*Olivella* shell fragment
-991b	"	"	1	clam-shell disk bead
-1001	"	40-50cm	1	*Olivella* shell fragment
-1003	"	"	1	clam-shell disk bead
-1011	"	50-60cm	2	Gastropoda
-1065	"	90-100cm	1	*Olivella* shell fragment
-1067	"	"	1	clam-shell disk bead
-1089	"	100-110cm	1	*Olivella* shell fragment
-1090	"	"	1	*Olivella* shell bead
-1110	"	110-120cm	1	*Olivella* shell fragment
-1442	8S-8W	50-60cm	1	*Olivella* shell fragment
-1506	"	100-110cm	1	Gastropoda
-1594	"	150-160cm	1	*Olivella* shell bead
-1608	"	160-170cm	1	*Olivella* shell bead
-1621	"	179-180cm	1	*Olivella* shell bead

Table based on data prepared by Susan Eugster

TABLE 34
Faunal Remains By Taxon

Taxon	NISP *	%	Burnt	%
Class Pisces (fish)				
Family Salmonidae	6	0.9	6	100.0
Class Aves (bird)	6	0.9	0	---
Class Mammalia				
Unidentifiable	66	89.3	130	23.0
Order Rodentia		0.5	0	---
Thomomys bottae	3	0.5	0	---
Sciuridae	11	1.7	1	9.1
Sciurus griseus	2	0.3	0	---
Family Ursidae	1	0.2	0	---
Order Artiodactyla	7	1.1	1	14.3
Odocoileus hemionus	10	1.6	1	10.0
Homo sapiens sapiens	19	3.0	0	---
TOTAL NISP	634	100.0	139	22.0
Unidentifiable	2	---	0	---
COMBINED TOTAL	636	100.0	139	22.0

* = Number of Identified Specimens

Faunal Analysis of CA-SHA-1544

by Parry Haskin

On May 25, 1989, the Zooarchaeology Laboratory at CSU, Chico received faunal remains from the archaeological site CA-SHA-1544, the Middle Mule Pond Site with the request by K. D. Tyree that the remains be identified and analyzed. Answers to specific questions regarding the nature of the material were requested. These questions concerned "subsistence related activities and their relative importance in the total subsistence system." Other questions regarded the type of site represented and what material was related to subsistence activities.

The assemblage consisted of 636 bone elements, of which 634 were identified to the Class level or beyond (Table 34). As is typical of sites in this area, most of the elements were mammal long bone shaft fragments. This was the case in 89% of this assemblage. It is interesting to note, however, that 22% of all the elements in the assemblage were burnt to some degree.

This report will include sections of methods of identification, taxonomic composition, and an analysis of the data. Inter- and intra-unit comparisons are not included after a careful perusal of the data indicated a wide dispersal of identifiable material, with one exception, which will be discussed in a later section.

Methods of Identification: The bone elements were identified at the CSU, Chico Zooarchaeology Laboratory, using the collection stored there. The work was performed under the guidance of Dr. Frank Bayham, an archaeologist at CSU, Chico. The individual elements in the assemblage were compared with the collection in the attempt to identify them to the nearest taxonomic level. Some written reference materials were also used in the attempt to differentiate between taxonomic groups (Gilbert 1980; Laurence 1951; Hall and Kelson 1959).

The taxa were recorded on faunal recording forms, which include the anatomical part, portion, size, side, age, and sex. A modification section includes burning, butchering, weathering, carnivore chewing, and rodent gnawing.

The quantification technique used was the Number of Identified Specimens (NISP). This technique utilizes the simple tallying of the specimen totals per taxonomic level. The small amount of identifiable bones in this assemblage rendered useless other quantifying techniques.

Taxonomic Composition: Most of the material represented in this assemblage is of the Class Mammalia, of which 89.3% was not identifiable to a further taxonomic level. Most of them were long bone shaft fragments. Many (23%) of these bones were burnet to some degree. Fifty-six of the elements were identified to a more precise taxonomic level within this Class.

The Order Rodentia was represented by 19 (3%) elements of the species *Thomoys bottae* (the burrowing pocket gopher), and 13 elements of the Family Scuridae (squirrels). Two of the Sciurid elements were identified as belonging to the species *Sciuris griseus* (the gray squirrel). The presence of rodents is usually indicative of intrusion, but is not always so, especially in the case of squirrels. They may have been a subsistence resource or taken for their fur.

One element from the Family Ursidae (bear) was identified in the assemblage. It was a first proximal phalanx of the hind leg.

The Order Artiodactyla was represented by the presence of 17 (3%) elements, of which 10 were further identified as *Odocoileus hemionus* (the black-tailed or mule deer). These particular elements, in tandem with the many large long bone fragments of mammals (especially those that were burnt), are most likely the result of subsistence activity. An interesting point is that only two of the Artiodactyl elements were burnt. It is possible that the burnt appearance of the mammal bone precluded its further identification.

The only other mammal represented in the assemblage is that of *Homo sapiens sapiens*. Nineteen elements (3%) of this species were identified. It is probably an indication of burials at the site, but is at the least a sign of human activity there. None of these elements was burnt.

The Class Pisces was represented by six elements, all of which were vertebrae of the Family Salmonidae. They were all burnt. This is 5% of the total bone at the site, but fish bone is notorious for not preserving well, so the number could well be under-represented. Fish could have been a subsistence resource, at least minimally.

The Class Aves was also represented by six elements (1%), none of which was burnt. The number is small, but there could have been a usage of avian resources at the site for subsistence, feathers, etc.

Analysis: The presence of the great percentage of undeniable mammal long bone shaft fragments make this a difficult assemblage to evaluate. The largest representation of mammals in the assemblage, disregarding the intrusive rodents, is shared almost equally between the Order Artiodactyla and the species *Homo sapiens sapiens*. None of the latter human elements was burnt, while some of the Artiodactyl elements were. A fair percentage of the unidentified mammal bone was burnt, indicating a possible subsistence activity, especially if they were found in association with the fire pits or other evidence of subsistence. This investigator feels that the major subsistence activity of the occupants of CA-SHA-1544 was the taking of Artiodactyls.

Artiodactyls comprised the major component of the assemblage that would have been used for subsistence. The small amount of fish and bird bone found at the site supports this, although they could have played a lesser role in the subsistence rounds. Based on the presence of Artiodactyl and mammal bone that was burnt, the site was probably a hunting camp.

The presence of human remains indicates burials based on the fact that 10 of the 19 human elements were found in Unit 8S-8W (see Table 35). This unit was the only one in which there was a concentration of a particular taxon. These burials may indicate a more than seasonal occupation of the site, although this is open to discussion. The presence of bone tool fragments indicates that there were work areas at the site also, as three bone tool fragments were all found in Unit 9N-1E. The work areas could be related to the fact that this site was most likely a hunting camp, and work was performed in conjunction with the hunting activities and possibly on the materials that were left over after subsistence, such as the processing of the hides into items of use.

Conclusions: The faunal material from this site indicates that a wide variety of activities were occurring. Hunting of Artiodactyls appears to have been the major subsistence activity, with a lesser reliance of other resources. The relative abundance of Artiodactyls in the assemblage seems to support this. The site itself was most likely a seasonal one, based on the relative lack of aquatic resources such as fish as well as the lack of other resources. This conclusion is of course reached only from the analysis of the faunal material. Projectile points, ground stone implements, and other aspects of material culture need to be brought to bear on the problem of determining the extent of the reliance on the fauna found in the assemblage. The presence or absence of these items can give a better idea of exactly what the major source of subsistence was at the site, as well as the problem of seasonality. But from the faunal material alone, the site CA-SHA-1544 appears to have been utilized as a seasonal hunting camp.

Table 35
Elements Identified as *Homo sapiens sapiens*

Cat. No.	Unit/Depth	Total Number	Anatomical Part/ Portion	Size	Age/ Fusion
97-323	3S-8W/20-30cm	3	pelvis / fragments	m	---
-787	9N-1E/50-60cm	1	phalanx / foot, 1 proximal	m	fused
-800	9N-1E/60-70cm	1	tibia / fragment	lg	---
-1044	8S-5E/80-90cm	1	tooth /max. canine	sm	11 yrs.
-1112	8S-5E/110-120cm	1	tooth / mand. canine	sm	---
-1312	7N-8E/60-70cm	1	palatine / fragment	m	---
-1441	8S-8W/50-60cm	1	navicular/fragment	sm	---
-1480	8S-8W/80-90cm	1	metacarpal / midshaft frag	sm	---
-1592	8S-8W/150-160cm	1	metacarpal / proximal fragment	sm	---
-1609	8S-8W/160-170cm	1	tooth . man. 1 premolar	sm	10 yrs.
-1609	"	1	phalanx / foot, 1 proximal	m	fused
-1609	"	4	vertebrae / 2nd cervical fragment	sm	---
-1620	8S-8W/170-180cm	1	phalanx / hand, 2nd	sm	---
-1620	"	1	phalanx / distal	sm	---

Note: Haskin's full tables of all bone fragments by unit and depth are on file at the Shasta College Archaeology Laboratory and at the Bureau of Land Management in Redding.

TABLE 36

Summary of Statistics for Freshwater Mussel

Unit	Total Shell Wt.	MNI *	Total Valves Identified
3S-8W	32.4	12	16
8S-11E	17.5	6	8
9N-1E	12.6	5	6
21N-3E	1.4	1	2
8S-5E	33.1	7	11
25S-12E	0.6	--	--
7N-8E	1.4	2	2
8S-8W	53.2	15	18
9N-14W	54.5	3	17
vdl/bckdrt	36.5	9	15
TOTAL	243.1	70	95

* = Minimum Number of Individuals

Note: Table prepared by K. D. Tyree based on Eugster's data table.
Full data table on file at the Shasta College Archaeology Laboratory and the Bureau of Land Management in Redding.

Freshwater Mussel and Marine Shell

by Susan Eugster

The majority of the shell collected from CA-SHA-1544 is freshwater mussel, primarily species *Margaritifera falcata*. A single fragment of the freshwater mussel *Gonidea angulata* was identified. These species are part of the greater Unionacean fauna (see Burch 1973 for identification). Both freshwater mussel species were widely distributed prehistorically in the rivers and streams of northern California; however, 20th century land and water modification has eradicated them from the majority of their previous habitats (Taylor 1981).

Freshwater mussels are a good source of paleoecological information. In addition, the analyses of these species are capable of addressing substantive archaeological issues, such as subsistence and settlement systems. Since bivalves maintain a permanent record of their growth, it is possible to assess age of the bivalve at death. Furthermore, season of its exploitation can be calculated (Chatters 1986).

A total of 243.1 grams of freshwater mussel was analyzed (Table 36). Minimum number of individuals (MNI), a commonly used measure of relative abundance, totaled 70. Unfortunately, there were no complete valves in the collection that could be used to determine age or season of death. This was due to the lack of integrity of the ligament portion of the valve. Many of the complete or near complete valves were very small and probably were eroded by depositional processes. Cursory examination of the valves suggests an age range of 5-15 years, with most between 5-10 years of age. This was determined by overall size of the valve; many were only 2-3 centimeters in width.

Marine shell identified included 11 *Olivella* shells and fragments and four clam-shell disk beads (see Table 33). Minimal analysis was completed on this part of the collection.

Freshwater mussel served primarily a nutritional function to hunter-gathering groups in central and northern California (Eugster n.d.). Alternatively, marine shell was traded into interior areas of the northstate serving primarily a prestige and status function (Bennyhoff and Hughes 1987). Based on the analysis of these shell remains, freshwater mussel contributed only minimally to the subsistence economy of the inhabitants of CA-SHA-1544. Since at least some of the marine shell was found in association with burials it appears that they served a prestige or status function or formed an offering.

Table 37
Results of Floral Analyses at CA-SHA-1544

	8S-8W 0-10cm Feat. 1	3S-8W 50-60cm Feat. 2	9N-14 50-60cm Feat. 3	3S-8W 20-30cm	3S-8W 50-60cm	3S-8W 110-120	Total
Sample volume (liters)	3.0	1.75	5.0	1.3	1.15	1.3	13.5
Large Taxa							
Manzanita stones #	2	6	26	3	19	3	59
gr.	.0181	.0326	.0780	.0097	.0633	.0093	.2110
embryos #	--	--	1	--	1	--	2
Gray pine hull #	3	1	15	5	10	1	35
gr.	.0831	.0303	.1033	.0293	.1234	.0125	.3819
Thin pine hull #	--	1	1	5	11	--	18
gr.	--	.0007	.0039	.0134	.0079	--	.0259
Acorn hull #	2	--	11	7	6	--	26
gr.	.0044	--	.0200	.0192	.0122	--	.0558
Hazelnut hull #	--	--	1	--	1	--	2
gr.	--	--	.0094	--	.0347	--	.0441
Unidentified hull #	5	--	2	--	1	--	8
gr.	.0174	--	.0016	--	.0016	--	.0206
Small Taxa							
Chenopodium sp.** (Goosefoot) #	--	--	--	--	1	--	1
Sambucus sp.** (Elderberry) #	--	--	--	--	1	--	1
Trifuliumn sp.** (Clover) #	--	1	--	--	--	--	1
Family Poaceae (grass) #	--	--	--	1	1	--	2
unknown #	2	--	--	--	--	--	2
seed fragments #	1	2	2	--	3	--	8

data from Wohlgemuth 1989, Tables 3 and 8.

Floral Remains

Soil samples, taken from a 10cm by 10cm column in the wall of Unit 3S-8W and extracted from Features 1, 2, and 3, were processed by the flotation technique. Samples varied from 1.3 to 5.0 liters in size, totaling 13.5 liters of soil. The technique employed for Middle Mule Pond varied slightly from other locally-used techniques in that five of the six samples were dried in window mesh (approx. 1.0 mm) rather than the 40 mesh/inch screen, potentially resulting in the loss of smaller materials.

The resulting botanical fractions were analyzed by Eric Wohlgemuth in conjunction with other samples taken from CA-SHA-1588, the Flat Creek site. As his report appears elsewhere (Wohlgemuth 1989), it is not repeated here. A summary is provided below, and Table 37 is based on Wohlgemuth's data.

Light fractions were gently passed through 1.75mm, 1.0mm, and 0.5mm screens to facilitate analysis, and all fractions were sorted. Material larger than 1.75mm was sorted with the naked eye, and smaller fractions were sorted at 10X magnification with a binocular microscope. All seed, fruit, and foliage remains were tabulated and recorded.

Large native taxa represented include grayleaf manzanita (*Arctostaphylos viscida*), gray pine (*Pinus sabiniana*), sugar pine (*Pinus lambertiana*), oak (*Quercus*) and hazelnut (*Corylus cornuta var. rostrata)*. Small taxa derived from the samples include: goosefoot (*Chenopodium* sp.), elderberry (*Sambuccus*_sp.), clover (*Trifolium*_sp.) and the grass family (Poaceae). Foliage was virtually absent at CA-SHA-1544 with the exception of one conifer needle.

Comparisons of the floral remains from CA-SHA-1544 and from prehistoric contexts at CA-SHA-1588, located on the Sacramento River north of Redding, are hampered by the loss of materials smaller than 1.0mm in five of the six samples from the former site. The macrofossils are common and well preserved. Large taxa are comparable in the two sites and show CA-SHA-1544 to have seven times the density of gray pine nutshell, but CA-SHA-1588 to have twice the manzanita density. Acorn and thin pine nutshell densities were found to be similar in the two sites.

Although hazelnut hulls are occasionally recorded in protohistoric/historic contexts locally, the Middle Mule Pond archeaobotanical assemblage contains notably, one of the few hazelnut hulls found in prehistoric contexts. Wohlgemuth relates, "Despite this scarcity in the archaeological record, ethnographic data repeatedly describes hazelnut as gathered in summer, shelled and eaten, or stored for winter . . ." (1989:10).

In addition to the column and feature samples processed by flotation, archaeobotanical remains collected in the initial screening process during test excavations were accessioned by unit and level. With the exception of Units 21N-3E and 25S-12E, all other eight units and the looters' backdirt contained pine nut fragments. Twenty-nine individual levels contained from one to eleven shell fragments. Many of the hulls are splintered or fractured; they are rarely whole and often charred. Additionally, but not surprisingly, pine nut shell specimens are present in Features 1 through 4. However, 69% (n=20 levels) of all pine nut fragments are associated directly with human bone/teeth, shell beads and/or manos.

Quartz Crystals

Numerous quartz crystal chunks/pieces were recovered from various units (including, but not limited to 3S-8W and 9N-1E) and all of the vandal backdirt quarters. It should be noted that although quartz crystals may be natural, some are undoubtedly cultural in origin exhibiting blunted, end-flaked terminations. DuBois indicates that the Wintu used quartz crystals as luck charms, specifically in gambling activities (1935:82). Locally, both Baker (Towerhouse, 1984:77-79) and Farber and Neuenschwander (Fay Hill, 1984:74) record quartz crystals, which may have some cultural significance.

Fire-Affected Rock

Fire-affected rocks (FAR) were measured, weighed and recorded for each level (Table38) and discarded at the site. Nearly 80% of all FAR averaged 2-8cm in diameter. Larger stones ranged from 12-15cm and rarely, 18-20cm in diameter. Features 1 through 4 contained extensive amounts of rock, and feature levels often constitute the greatest amount of FAR for the unit.

Table 38

Fire-Affected Rock By Unit and Level

	Pounds per Level									
Level/cm	8S-8W	7N-8E	8S-11E	3 S-8W	17S-12E	21N-3E	8S-5E	9N-14W	9N-1E	25S-12E
0-10	99	29	21	4	49	35	16	62	48	34
10-20	169	9	54	16	103	26	62	105	102	57
20-30	97	44	44	153	67	10	133	70	51	78
30-40	152	19	100	202	90	52	81	22	38	85
40-50	87	31	70	61	81	--	138	24	101	102
50-60	67	35	90	43	44		98	31	112	111
60-70	95	60	93	81	17		123	23	120	110
70-80	100	98	104	123	--		77	18	38	148
80-90	90	82	42	100			74	29	13	60
90-100	55	20	5	50			85	23	15	--
100-110	51	11	2	50			51	8	19	
110-120	88	--	--	30			20	--	19	
120-130	31			34			18		--	
130-140	23			41			1		6	
140-150	12			23			--		8	
150-160	7			9					3	
160-170	20			21					--	
170-180	--			--						

DATING TECHNIQUES

Radiocarbon Dating

Charcoal fragments and/or chunks collected from Middle Mule Pond included both specimens in direct association with features and those occurring randomly throughout the deposit. Two charcoal samples from Unit 3S-8W, one extracted from Feature 2 at 40-50cm in depth, the other from the terminal level of 170-180cm, were submitted to Beta Analytic Inc. of Florida for radiocarbon assays. Results appear as Table 39.

Obviously, the vertical distribution and depositional integrity of Unit 3S-8W are called into question. However, with the exception of stratigraphic inversion likely caused by disruptive bioturbation, the radiocarbon date from Feature 2 may be entirely feasible. Projectile point typological relationships recovered within the unit appear to retain integrity, within allowable parameters, when compared with other local sites The 170-180 cm sample was a very small collection of random charcoal and was not obtained from a feature. The date probably reflects intrusion of more recent charcoal into lower levels by burrowing rodents or burnt roots. Obsidian results and typological cross-dating of projectile points clearly point to a much earlier date that obtained for the terminal date.

Table 39
Results of Radiocarbon Analyses

Beta Lab No.	Provenience	Years before present	Date
-29466	3S-8W/40-50cm (Feature 2)	1750 +/- 60 BP	A.D. 200
-29465	3S-8W/170-180 (terminal)	410 +/- 80 BP	A.D. 1540

Obsidian Hydration and Sourcing

Obsidian hydration analysis was performed on 28 specimens, and 17 of these were also geochemically sourced. Fourteen of the specimens were recovered in 1986 from the looters' backdirt and the remaining 14 were collected in 1988 from seven of the ten excavated units. Obsidian hydration studies were performed by Thomas Origer, Sonoma State University and obsidian source analyses were conducted by Dr. Richard Hughes. Results are summarized below and are combined on Table 40.

Hydration readings are varied. Tuscan obsidian, the dominant source, spans from 1.0 to 4.3 microns; and Grasshopper Flat/ Lost Iron Wells/ Red Switchback (GF/LIW/RS), ranges from 1.0 to 6.6 microns. Stratigraphic association of these readings are variable, yet diagnostics, when plotted by type and micron reading are generally viable with local projectile point type trajectories.

TABLE 40
Obsidian Hydration and Sourcing Data

Catalog #	Artifact Type	Unit Level/cm	Rim Reading/ microns	Obsidian Source*	Years BP
97-0009	corner-Notched	Vndl/bckdrt	2.8	Tuscan(x)	2450
-0029	Gunther	Vndl/bckdrt	1.0	Tuscan(x)	648
-0031	Gunther	Vndl/bckdrt	1.7	Tuscan(x)	1203
-0055	biface fragment	Vndl/bckdrt	2.1	Tuscan(x)	1710
-0148	corner-Notched	Vndl/bckdrt	3.3	Tuscan(x)	3133
-0149	Gunther	Vndl/bckdrt	2.3	Tuscan(x)	1902
-0233	McKee	Vndl/bckdrt	6.6	GF/LIW/RS(x)	4196
-0253	debitage/flake	Vndl/bckdrt	1.0	GF/LIW/RS(x)	200
-0260	side-Notched	Vndl/bckdrt	1.7	Tuscan(x)	1203
-0265	corner-Notched	Vndl/bckdrt	no visible band	Tuscan(x)	---
-0269	corner-Notched	Vndl/bckdrt	2.4	Tuscan(x)	1998
-0277	corner-Notched	Vndl/bckdrt	2.3	Tuscan(x)	1902
-0283	debitage/flake	Vndl/bckdrt	1.2	Tuscan(x)	812
-0284	debitage/chunk	Vndl/bckdrt	3.9	GF/LIW/RS(x)	1790
-0519	debitage/flake	3S-8W, 150-160	2.6	Tuscan(v)	2190
-0525	corner-Notched	3S-8W, 150-160	4.3	Tuscan(v)	4515
-0528	debitage/flake	3S-8W, 160-170	2.6	Tuscan(v)	2190
-0629a	side-Notched	8S-11E, 50-60	2.6	Tuscan(v)	2190
-0629b	side-Notched	8S-11E, 50-60	2.5	Tuscan(v)	2094
-0665	scraper	8S-11E, 70-80	2.6	GF/LIW/RS(x)	950
-0679	Gunther	8S-11E, 80-90	4.3	GF/LIW/RS(x)	2110
-0814	corner-Notched	9N-1E, 70-80	4.0	Tuscan(v)	4035
-0889	Biface	9N-1E, 130-140	3.6	GF/LIW/RS(x)	1566
-1062	small stemmed	8S-5E, 90-100	2.6	Tuscan(v)	2190
-1160a	side-Notched	25S-12E, 0-10	2.5	Tuscan(v)	2094
-1160b	side-Notched	25S-12E, 0-10	2.5	Tuscan(v)	2094
-1231	corner-Notched	25S-12E, 70-80	2.2 faint	Tuscan(v)	1806
-1321	debitage/flake	7N-8E, 80-90	1.5	Tuscan(v)	1049
-1322	debitage/flake	7N-8E, 80-90	4.0	GF/LIW/RS(v)	1870
-1891	McKee Uniface	17S-12E, 50-60	4.0	Tuscan(v)	4035

(x) = sourced by XRF (v) = visually sourced

Hydration studies have included an attempt to detect possible alternative obsidian procurement strategies. Skinner suggests:

> Despite the fact that the possibility of scavenging has been recognized in the literature for at least 20 years, it is usually only mentioned in passing to explain anomalies in the hydration data . . . Its significance for the structure of the archaeological deposits and assemblages and the ramifications for the interpretation for the late prehistoric period obsidian exchange network have never been explored, nor has there been any effort to structure field and laboratory techniques to test explicitly whether scavenging was a major procurement strategy in the late prehistoric period (1988:7).

To test for potential scavenging and/or reuse of projectile points at Middle Mule Pond, two of the side-notched specimens (97-629 and -1160) were subjected to two selective hydration cuts each, one on the lateral margin and one on the base. These specimens were initially selected due to apparent reworking (i.e. heavily arrised, exhibiting multiple flakes scars) and morphological/typological similarities despite obvious provenience discrepancy (Units 25S-12E/0-10 and 8S-11E/50-60, respectively). Test results suggest that evidence of variable hydration bands between blade and base was negligible (2.5 and 2.6 microns, respectively) and does not support an hypothesis of the scavaging and reuse of the artifacts.

Recent obsidian studies of northern California have centered on understanding and correlating the effects of temperature on various sources for the purpose of developing "provisional hydration rates for obsidians common to north-central California" (Basgall and Hildebrandt 1989:195). The rate of conversion involves: radiocarbon rates = micron readings = calendrical years.

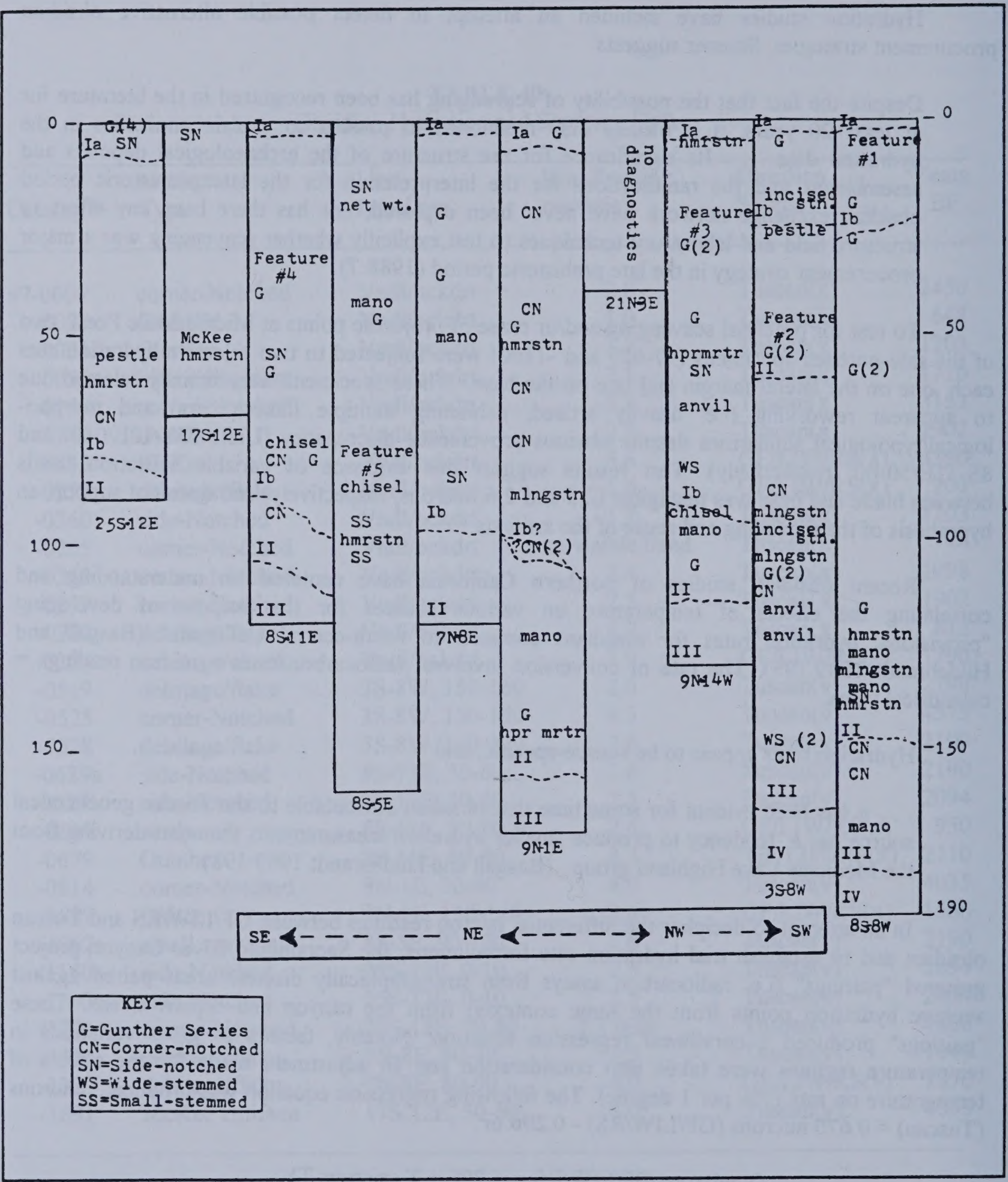
Hydration rates appear to be source-specific, and

> . . . it has been evident for some time that obsidian attributable to the Tuscan geochemical source has a tendency to produce smaller hydration measurements than that deriving from the Medicine Lake Highland group...(Basgall and Hildebrandt 1989:198).

In an attempt to decipher the differential micron readings between GF/LIW/RS and Tuscan obsidian and to establish trial hydration rate formulations, the Sacramento River Canyon project grouped "pairings" (i.e. radiocarbon assays from stratigraphically discrete areas paired against average hydration points from the same contexts) from the canyon and Squaw Creek. These "pairings" produced a curvilinear regression equation. Notably, factors of gross variations in temperature regimes were taken into consideration and an adjustment made for the effects of temperature on rate (7% per 1 degree). The following regression equation was produced: microns (Tuscan) = 0.670 microns (GF/LIW/RS) - 0.296 or:

$$\text{X microns GF/LIW/RS} = \frac{(.296 + \text{Y microns T})}{(.670)}$$

Using the cumulative data for the Sacramento River Canyon, samples from the Middle Mule Pond site, corrected for mean temperature variance, were then assigned calendrical date equivalents as recorded on Table 40.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100
150
190
SE
NE
NW
SW
KEY-
G=Gunther Series
CN=Corner-notched
SN=Side-notched
WS=Wide-stemmed
SS=Small-stemmed

Figure 32. Summary of selected artifacts and site characteristics by unit and depth.

CONCLUSIONS

SUMMARY OF CULTURAL MATERIALS AND STRATIGRAPHY

Archaeological field investigations at CA-SHA-1544 have yielded an inventory of 8,699 artifacts. Flaked stone artifacts consist of cores, edge-modified flakes, unifaces, bifaces, projectile points, and large quantities of debitage. Groundstone artifacts include manos, hopper mortars, pestles, millingstones, chisel/wedges, hammerstones, anvils, a net weight, and several incised items. Several bone tools and shell beads were classified. Ecofacts and organic materials include faunal remains, freshwater mussel shell, and fire-affected rocks.

Five concentrations of cultural materials were identified. Features 1 and 2 were burned areas, probably fire hearths. Features 3 and 4 were circular rock-lined areas that are believed to have served as baking ovens. Feature 5, which contained numerous pieces of bark, shell beads, obsidian debitage and small fragments of human bone, was interpreted as a probable burial cover. Although no human interments were recognized during the field excavations, nineteen fragments of human skeletal material were later identified within the faunal assemblage. These came from four areas of the site in addition to Feature 5. Figure 32 summarizes selected data by provenience.

Owing to the lack of horizontal uniformity across the site, it is difficult to assess site stratification and component definition. Chemical tests and other geomorphological analyses do suggest, however, that this site was a substantial habitation location over a period of several thousand years. Two to four soil strata, varying by unit, have been identified. The maximum strata are represented in central portions of the site where more intensive human activities and/or deposition-forming events occurred. Deeper levels of the site are thought to signify more intermittent use than during the period of principal occupation. Surface levels suggest a less intense utilization of the site as measured by reduced phosphorus and calcium readings, yet it is noted that this may be due, in part, to post-occupational soil-sediment contributions.

DATING AND COMPONENT BUILDING

Three techniques were of use in assigning dates to the Middle Mule Pond site and to the components within the cultural deposit. Two radiocarbon dates, 30 obsidian hydration rim measurements, and the consideration of 56 typed projectile points with regional temporal associations were applied to the cultural materials.

Radiocarbon Dating

Two charcoal samples from Unit 3S-8W (40-50 cm and 170-180 cm) were submitted to Beta Analytic, Inc. Results appear to emphasize the lack of depositional integrity within the unit. The upper level yielded a date of 1750 +/- 60 BP whereas the terminal date extracted for the unit is 410 +/- 80 BP. Although the upper strata date of 1750 BP may be entirely reliable, the terminal date is assumed not to accurately date the cultural level or to represent an intrusive feature such as a rock oven.

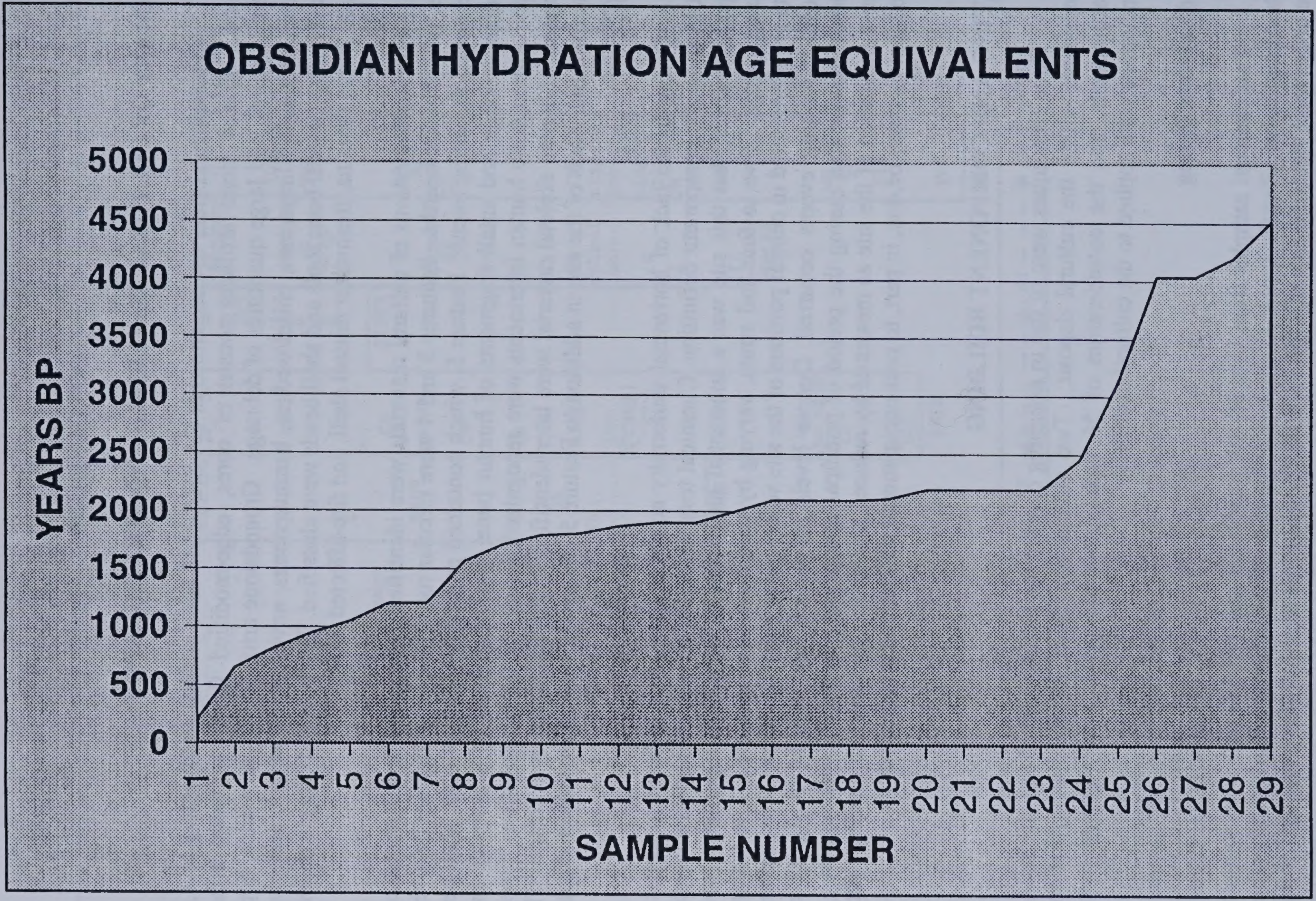

Figure 33. Obsidian hydration age equivalents (prepared by Eric Ritter).

Obsidian Hydration

Obsidian hydration analysis was performed on 28 specimens. Hydration readings are varied. Tuscan, the dominant source, yielded values from 1.0 to 4.3 microns and Grasshopper Flat/Lost Iron Wells/ Red Switchback (GF/LIW/RS) provided values of 1.0 to 6.6 microns. Stratigraphic placement of the analyzed specimens is somewhat mixed, and direct correlations between increasing depth and increasing source-specific micron values is not always evident. Since most obsidian hydration measurements were completed on projectile points and McKee Unifaces, specific artifact values are discussed in greater detail in the section that follows.

Source-specific differential micron readings were assessed by the use of trial hydration rate formulations (cf. Basgall and Hildebrandt:1989) and adjusted for variations in local temperature regimes. Assigned calendrical date equivalents for diagnostics are comparable to calculated dates from other local sites (cf. Farber et al.:1985; Basgall and Hildebrandt: 1989; Clewett and Sundahl: 1980, 1981, 1982, 1983; Sundahl:1982, 1986). Conversions of hydration values provide dates for the site between 200 and 4515 years before present. Assuming these dates are relatively accurate, there appears to be at least three periods of prehistoric occupation spanning the last four millennia (Figure 33).

Discussion of Temporally Sensitive Projectile Points

Projectile points from the Middle Mule Pond Site are classed into five generalized types that, along with McKee Unifaces, are considered temporally sensitive. Stratigraphic data from the Middle Mule Pond site clearly shows a sequence in projectile point types, albeit imperfect (refer to Figure 20), indicating relative dates. The mean depths of each type within the site deposit provide a gross measure of their relative ages (Table 41). Very large ranges and standard deviations suggest considerable disturbance within the midden, but the mean depth sequence is largely what might be expected. Point types plotted by obsidian hydration values are shown in Figure 34.

TABLE 41
Projectile Point Types by Mean Depth in CA-SHA-1544.

Point type	Number in Sample	Depth in cm Range	Mean	Standard deviation
Gunther Series	27	0-150	50	39
side-notched	7	0-140	54	47
McKee Unifaces	3	0-170	75	82
small stemmed	2	90-100	95	-
corner-notched	14	20-170	99	39
wide stemmed	3	80-150	125	35

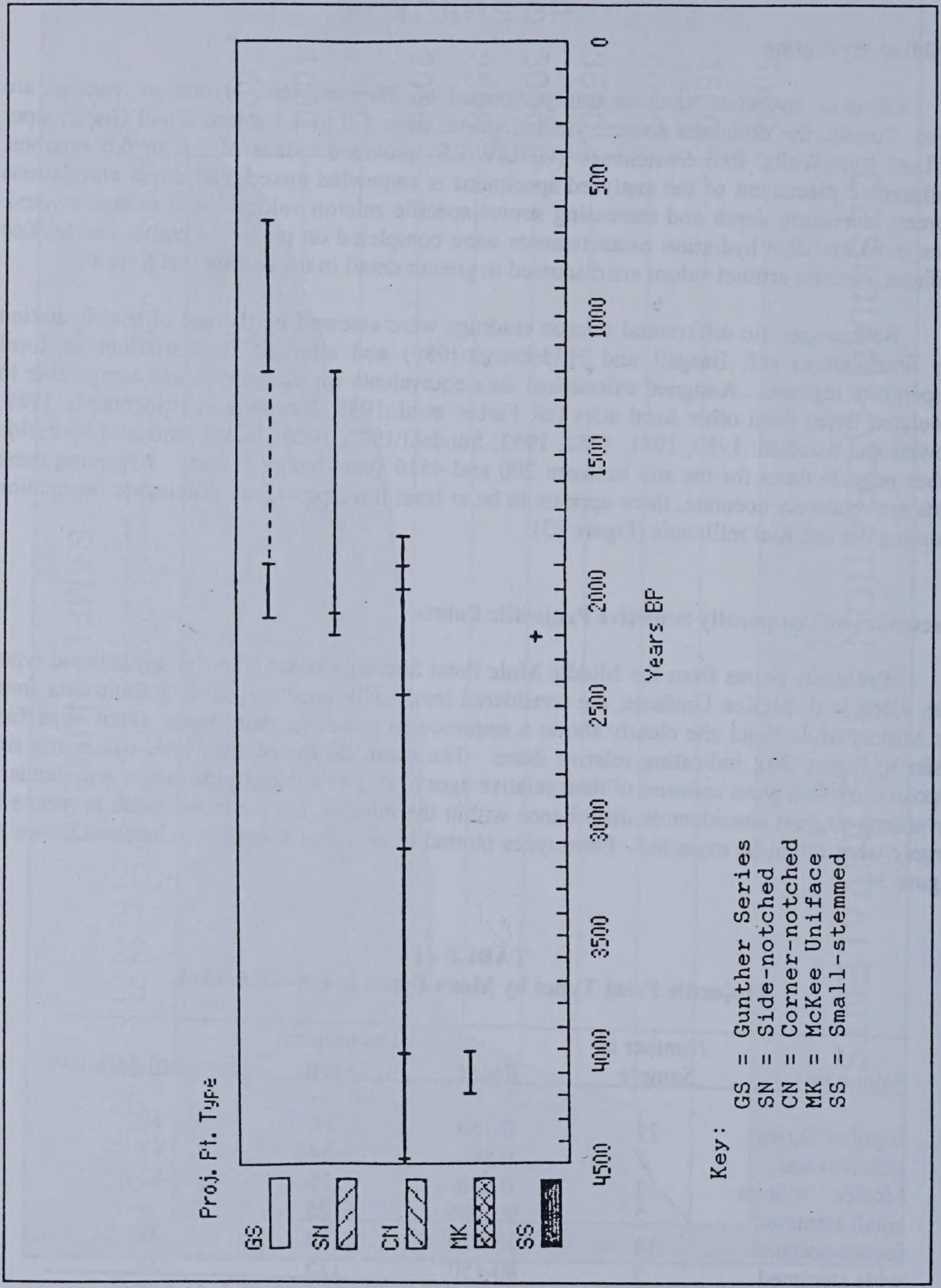

Figure 34. Diagnostic projectile points plotted by type and age, based on obsidian hydration.

Gunther Series Points: Although Gunther series points are considered by all researchers to be late-period temporal markers, there is no consensus as to the exact definition and size parameters (e.g. Olsen 1996). Mapping the extent of Gunther barbed points from Oregon southward throughout the Sacramento Valley, Jackson and Schulz (1975) define the type as including "all medium to small stone projectile points characterized by trianguloid blades, contracting or parallel stems, pronounced shoulders with angles of less (usually considerably less) than 75 degrees, and with base profiles (the proximal border of the blade from shoulder to shoulder exclusive of the stem) concave or indented" (Jackson and Schulz 1975:2). The term Gunther series has come into common usage in northern California to include similar points that have a straight rather than concave proximal base.

Gunther series points comprise slightly greater than half of the provenienced typable points from Middle Mule Pond. Nearly all upper levels of CA-SHA-1544 contain Gunther points while only five specimens occur in levels below 70 cm. Most hydration readings from Middle Mule Pond are comparable with other regional age determinations of 1500 BP-to-historic with values on Tuscan obsidian of 1.0, 1.7, and 2.3 microns. In general, Gunther series projectile points exhibit hydration values in the Redding area of up to 2.0 microns on Tuscan obsidian, but exceptions are known (e.g. rim readings in microns of 2.0, 2.1, and 2.3 at CA-SHA-222 and 2.1 and 2.4 at CA-SHA-1485 [Sundahl and Clewett 1985:93,104]. Roughly, the aforementioned hydration readings, when adjusted for temperature variance, may be equated with 1500-2000 calendrical years BP [Basgall and Hildebrandt 1989:200]).

It is noteworthy that, although the lower strata Gunther points from Middle Mule Pond (97-679, -441, and -896), here termed Gunther-like, are aligned morphologically and metrically with other local forms, they are generally heavier and thicker in cross-section (other "thicker" Gunthers are non- provenienced). Hydration rims on selected points of 2.3 microns (Tuscan) and 4.3 microns (GF/LIW/RS) differ from other intrasite readings and suggest early dates of 1900-2100 BP. Although these dates may indeed be extraordinary, Basgall and Hildebrandt indicate ". . . there remains some uncertainty as to when [Gunther series points] first appeared, and whether morphological variation within the group is temporally significant" (1989:123).

Although included within the Gunther series type in this analysis, the larger Gunther-like points are sometimes treated as aberrant, or are classed as a separate point type. A group of 24 Gunther-like points found in CA-SHA-471 in the foothills east of Redding were included in that report as "stemmed points." Morphologically similar to Gunther points, they are larger, thicker, and have wider stems. Proveniences were slightly lower in the site than the Gunther Series points (Sundahl and Clewett 1991:99). There is also a larger, earlier form, perhaps not related, found in the Southern Cascades and in the Sacramento Valley from Chico and Oroville southward (Eric Ritter, personal communication 2002).

Therefore, some micron readings (Tuscan > 2.0, GF/LIW/RS > 3.8, Redding area-specific) for Gunther series or Gunther-like projectile points, rather than aberrations, may indicate either an earlier temporal span of these point types or lend credence to the possibility of a morphologically similar yet temporally disparate point type in northeastern California.. If excluded from the Gunther type, the cultural significance of these Gunther-like points is unclear

Side-Notched Points: With the exception of two side-notched specimens to be discussed later, the other four provenienced side-notched points from Middle Mule Pond were recovered from the upper half of their respective units. The upper stratigraphic placement of these points may tempt the conclusion that these four are manifestations of Desert Side-Notched (DSN) variants, although as was noted earlier, only one specimen (97-1834) morphologically resembles local general DSN variant styles. Matched with hydration values, however, these points pose a dilemma, for they exhibit rim readings of 2.5/2.5 microns (base/blade of 97-1160) and 2.6/2.5 (base/blade of 97-629), both visually sourced as Tuscan. These "old" readings are not comparable with that of other regional DSN's, which rarely have readings greater than 1.3 microns (GF/LIW/RS) (Basgall and Hildebrandt 1989:132). It may be possible that despite the utilization of these side-notched forms in what appears to be a late to very late context, they were initially fashioned in a much earlier temporal period.

The two specimens (97-1331, and -1553) that were found in the lower one-third of their respective units more closely resemble the so-called Clikapudi Side-Notched Series from the Sacramento River Canyon Project (Basgall and Hildebrandt 1989:143-148) where they co-occur with corner-notched points at 3000-2000 BP (Basgall and Hildebrandt 1989:133). There are no hydration values available from CA-SHA-1544 to support or refute these regionally given dates.

At nearby CA-SHA-1991, the 97 corner-notched and side-notched points intergrade to some extent, with a few specimens being corner-notched on one edge and side-notched on the other. Depth proveniences between the two varieties were similar. As a group, obsidian hydration values at CA-SHA-1991 range from 1.4 to 3.8 microns with a mean of 3.36 microns on GF obsidian, and from 1.3 to 5.9 microns with a mean of 2.33 microns on Tuscan obsidian (Sundahl 1998:58).

Corner-Notched Points: Corner-notched points appear to have the longest time span and to be one of the earliest forms at the site. Eleven of the 14 provenienced corner-notched specimens were located in the lower half of each of their respective units. Artifact 97-525, from a depth of 150-160 cm in 3S-8W and visually sourced as Tuscan, contains a hydration band of 4.3 microns. This artifact was located below wide-stem point forms considered "ancient." However, a terminal radiocarbon sample taken from the bottom of the same unit (170-180 cm) yielded a date of 410+/- BP, strongly suggesting the possibility of disturbance.

Unit 9N-1E is the only unit that contained corner-notched specimens throughout. The three points recovered from the upper levels were found between 20-80 cm in depth. Human bone fragments were interspersed in the aforementioned levels, and may account for the traditionally earlier corner-notched points being recovered in upper strata due to disturbance. Notably, one of these points (97-814) from the upper levels of 9N-1E, visually sourced as Tuscan, has a hydration value of 4.0 microns. All others range from 2.2 to 3.3 microns on Tuscan obsidian.

Corner-notched points at Middle Mule Pond verify other regionally available research as a pre-Gunther temporal marker. The prevalence of these points in the lower strata, however, does not affirm a general co-occurrence with side-notched points (Basgall and Hildebrandt 1989:133); rather they appear in the earliest phases of site strata.

Stemmed Points: The forms potentially identified with Squaw Creek Contracting-Stem (n=2) and Borax Lake Wide-Stem (n=3) were recovered from the lower one-half of Units 3S-8W, 9N-14W and 8S-5E. They may, in fact, be attributed to an "early" component. Squaw Creek Contracting-Stem points are dated between 5000 and 3000 BP in the Sacramento River Canyon (Basgall and Hildebrandt 1989) and at Squaw Creek (Clewett and Sundahl 1983). Borax Lake Wide-Stem points found on Squaw Creek are dated between 8000 and 5000 BP (Clewett and Sundahl 1983) and are the earliest points found in the South Fork Mountain-Pilot Ridge sequence in the North Coast Ranges (Hildebrandt and Hayes 1984).

As mentioned previously, the so-likened Squaw Creek Contracting Stem points are, perhaps fortuitously, associated with human bone fragments, shell beads, and bark slabs in Feature #5. Of interest is the circumstance that no other diagnostic artifacts were found below this presumed burial.

Wide-stemmed specimens were recovered stratigraphically slightly deeper than the small-stemmed forms. These Wide-Stemmed points are unusual in that they are fashioned of non-local Franciscan chert, and may have been an item of trade in completed point form. Alternatively, the annual rounds of site inhabitants during this early period may have included trips into the higher elevations of the North Coast Ranges where chert exposures could be exploited. Although no definitive chronometric date can be ascribed to these artifacts at Middle Mule Pond, they are potentially related to an early phase of prehistory regionally dated as circa 7,500-3,000 BP.

McKee Unifaces: The four McKee Unifaces recovered from the site had widely varying proveniences, from the surface to the 160-170 cm level. Dates obtained from the two specimens submitted for obsidian hydration analysis, however, are very consistent at 4035 and 4196 BP. These dates agree very well with data from other area sites where these artifacts are placed in a 5000 to 3000 BP temporal framework (e.g. Basgall and Hildebrandt 1989; Bevill and Nilsson 1999; Sundahl 1999).

Site Components

Dating techniques indicate that the Middle Mule Pond site was occupied over the past four thousand years. Temporal/spatial apportionment of several periods of extended occupation are suggested by hydration values (see Figure 33) and projectile point types. Diagnostics with datable applications range from corner-notched points (4515-1800 years BP), McKee unifaces (4195-4035 years BP), side-notched points (2190-1200 years BP), a small-stemmed point (2190 years BP) and Gunther series points (2110-650 years BP). The following components and/or occupation periods have been artifactually defined and tentatively characterized based on the combined analyses noted above.

Early Period: Dating from more than 4000 to 3000 BP, this period was characterized by millingstones, manos, anvils, incised stone, wide-stemmed and corner-notched projectile points, and McKee unifaces. Debitage was overwhelmingly of local metavolcanic materials but also included Grasshopper Flat and Tuscan obsidian.

Middle Period: With proposed dates of 3000-1750 BP, this period is represented by millingstones, manos, hopper mortars, pestles, hammerstones, and projectile points of the corner-notched, side-notched, narrow-stemmed and "thicker" Gunther-like types. Debitage is nearly equally divided between metavolcanic and obsidian materials with some chert debitage present. If the frequency of dates based on the sample submitted for obsidian hydration analysis is representative of the site, this period saw the most intensive use (refer to Figure 33). A radiocarbon age of 1750 BP on a fire hearth feature may date the termination of this period.

Late Period: Dated between 1750 and 500 BP, this period was the main occupation based on numbers of representative projectile points and other artifacts. Characteristic artifacts include hopper mortars, pestles, hammerstones, chisel/wedges, incised sucker charm, net weight, bifacial drill, and Gunther series projectile points. Millingstones, manos, anvils, and non-DSN side-notched points may have been in use during the earliest part of the period. Obsidian debitage predominates, although both metavolcanic and chert materials minimally are present.

ADAPTIVE STRATEGIES

Subsistence

Subsistence orientations of the inhabitants throughout most of the site history appear to have been focused on the procurement of large game (predominantly deer and, minimally, bear), various species of bird and salmon, freshwater mussel, seed and probably root resources. Given the stratigraphic complexity of the site, there is apparently only subtle shifting of focused economies through time. This observation is based on the considerable degree of stratigraphic overlap of the various artifacts associated with food procurement and processing. Groundstone types, for instance, manos, millingstones, and anvils, although present throughout most of the occupation, are stratigraphically concentrated in the lower two-thirds of the site. On the other hand, hopper mortars, pestles, and hammerstones cluster in the upper two-thirds of the strata. Given the relative variety of groundstone artifacts, it is noteworthy that comparative intersite analyses of vegetal remains found that at CA-SHA-1544 pine nut shell remains were more prevalent than acorns. Manzanita and hazelnut remains and many small taxa were also present. Unfortunately, without starch and phytolith analysis of groundstone, the place of geophytes in the diet is uncertain.

The occurrence of net weights and probable sucker charms in the middle and late periods may demonstrate a greater dependence on a fishing economy. Additionally, six calcined salmon bones, unusually preserved in a locality in which late prehistoric-protohistoric peoples are known to have pulverized fish bones, suggest that potentially fortuitous burning, whether by humans or by nature, prevented total decomposition of the bones. Aquatic remains, including freshwater mussel, although minimal, may have been an important resource noting the sites' relationship to the waterway.

Projectile points, although obviously varied in their typologies, occur consistently throughout the occupation and signify the importance of hunting. The most dominant tool form, edge-modified flakes, potentially represents tools for butchering, processing and other subsistence activities. Edge-modified pieces are found from the earliest to the most recent periods. Faunal analyses indicate that the hunting of artiodactyls was of primacy importance among the collection of animal foods.

Seasonality

Annual salmon runs, summer and fall harvesting of hazelnuts, pine nuts, and acorns and the seasonal migratory tendency of larger fauna to relocate at lower elevations, suggest that Middle Mule Pond was occupied intermittently during the year. However, possible burials along with associated grave goods such as beads, and an incised pendant, found in varying strata throughout the site, may lend credence to arguments for a more sedentary year-round or near year-round occupation toward the later end of the occupation.

Additionally, arguments for a sedentary pattern at Middle Mule Pond may be obtained indirectly from the extremely young age of shellfish remains. Modern unexploited populations of *M. margaritifera falcata* often have modal ages of over 70 years (Chatters 1986:26). Middle Mule Pond specimens however, range in age from 5-10 years and suggest intensive exploitation. Sedentary patterns at Middle Mule Pond may have resulted in an overexploitation of shellfish.

Sedentism also may be indicated by the primary, secondary, and tertiary reduction of local and non-local debitage materials at the site. Local materials appear to have been generously and expeditiously reduced, particularly in earlier levels. Debitage predominantly resulting from early to late core reduction implies not only the frequent "testability" of materials but, the possibility of extended residency (cf. Shackley 1986).

With regard to the extensive use of locally available material for cores (and by extension, the debitage used for retouched tools), the residential camp model for collectors described by Kelly similarly predicts that "the logistical aspect may require an efficient, but perhaps flexible technology, while the residential aspect may make use of an expedient technology" (1985:12).

Additionally, it has been noted that there is a marked increase of obsidian debitage preferred over metavolcanic toolstone in the most recent occupation. Subsequent tool specificity and complexity (including, but not limited to, the preference of obsidian over local materials) should increase as logistical mobility increases (Kelly 1985:19). A gradual increase in obsidian utilization, therefore, may be indicative of external pressure (locally exhausted biotic resources induced by extended residency?) which necessitated greater logistical mobility in the most recent occupational episodes.

Trade/Exchange

Tuscan and GF/LIW/RS obsidian appear to be the only sources used by Middle Mule Pond inhabitants. Visual and chemical sourcing indicates that Tuscan glass is the primary source, although GF/LIW/RS was also used throughout the entire occupation period of the site.

Ethnographic records for the Wintu suggest that Tuscan obsidian was obtained either directly, or by trade with the Yana. The GF/LIW/RS obsidian lies in or near the territory of the Achumawi (Pit River) and Shasta Tribes, and may have been obtained through trade with these groups.

Clam shell disk and *Olivella* beads were recorded in conjunction with human bone, teeth and possible burial features. It may be assumed that these beads were obtained in some manner from the Pacific Coast, probably indirectly. Such wealth items, although minimally represented, suggest possible trade links to the west and/or south.

Settlement Pattern

The early peoples at Middle Mule Pond, circa 4000 to 3000 BP, appear to have mainly occupied the central and southwest portion of the site. Subsequent or continuous occupations at the site shifted to eventually include the entire site by 3000-1750 BP. A shallow deposit, and late temporal markers (Gunther series projectile points) in the northern periphery at the greatest distance from the waterway, may imply population expansion and/or a large village settlement in the late period.

Areal relationships among Early Period peoples are the least clear. Similar assemblages, assigned to the Pollard Flat phase in the upper Sacramento River canyon, are believed to represent a forager-like subsistence-settlement pattern in which the entire social unit moved seasonally from place to place with little settlement differentiation. It was proposed that sites of this type were most commonly found in montane forest setting near the blue oak-gray pine ecotone (Basgall and Hildebrandt 1989:444, 447).

Like Middle Mule Pond, very few artifacts temporally diagnostic of the Early Period were found at nearby CA-SHA-1991 (Sundahl 1998) or in numerous sites in the Whiskeytown Lake area where they are dated as pre-3275 BP (Baker 1990:105). There are insufficient artifacts and cultural associations to say much more than Middle Mule Pond and surrounding site locations were briefly occupied by a foraging peoples, probably as seasonal base camps.

Middle Mule Pond during the Middle Period of 3000 to 1700 BP appears to have been a village site, possibly used most intensively during the fall and winter seasons. Similar rich components occur at CA-SHA-1991 and at a number of sites in the Whiskeytown Lake area, such that the name Whiskeytown Pattern was suggested to describe this cultural expression (Bevill and Nilsson 2001:71, Sundahl 1992b). It has been proposed that the settlement pattern during this period consisted primarily of fall-winter villages in foothill locations with seasonal base camps at higher elevations and in riverine settings. Artifact assemblages during this time became more differentiated among these different environmental zones with tool kits geared toward specific tasks.

Settlement patterns during ethnographic time are well documented. Major Wintu village locations were set on the banks of streams or rivers (DuBois 1935:28), and smaller sites were common on terraces and knolls near small creeks. The Middle Mule Pond site, located six miles from the Sacramento River and situated on a small knoll overlooking Olney Creek, may be, in the most recent occupation, a typical Wintu village.

THE RESEARCH POTENTIAL OF THE MIDDLE MULE POND SITE

In considering the major themes used in developing prehistoric models, the Middle Mule Pond site has much to offer. Approaches commonly used in modeling local prehistory include chronology, environmental, subsistence/settlement, and cultural/linguistic frameworks.

Research to date and reported here has contributed the most to regional chronology. With evidence for at least 4000 years of prehistory, the Middle Mule Pond site has been demonstrated to contain radiocarbon-dated features, abundant obsidian for hydration analyses, and a wealth of time-sensitive artifacts.

Although cultural remains from pre-3000 BP contexts are relatively few and some deposits are mixed, untested portions of the site may prove more productive. Borax Lake Wide-Stem points, rare in such low-elevation settings, are clearly present. Made of chert, they imply connections to the higher North Coast Ranges. A rich deposit dated to the Middle Period offers the potential to contribute much to the further understanding of this cultural phenomenon. And the Late Period occupation provides possibilities for understanding the role of the foothill environment in the Wintu life style.

Many minor points have yet to be resolved. For instance, the early part of the Late Period, dating approximately from 1750 to 600 BP, appears to be well represented at Middle Mule Pond. This contrasts with neighboring CA-SHA-1991, which seems to have a hiatus between the middle and late components, the latter radiocarbon dated as originating around 600 BP (Sundahl 1998). Likewise, CA-SHA-961, located on Olney Creek where it joins the Sacramento River, contains several radiocarbon dates beginning at 600 BP (Jensen 1994). The Middle Mule Pond site can offer valuable information on how changes took place and possible interactions among different cultural groups during this transitional period.

It has been proposed that the arrival of the Wintu in northern California, expressed archaeologically as the Shasta Complex or the Redding Aspect of the Augustine Pattern, first took place along the Sacramento River between Redding and Cottonwood, dating some 1000 or 1200 years ago. Only when the riverbanks were fully populated given the technological and social structure, did Wintu groups begin establishing villages on smaller tributary creeks (Sundahl 1982:196-198; Jenson 1994:65-66). Situated in a foothill setting, the Middle Mule Pond site has contributed information on subsistence adaptations to this environment over time and the role it may have played in altering (or not altering) Wintu adaptations.

The preservation of faunal and floral materials is demonstrated, and along with the recovery of functionally diagnostic artifacts, can provide data specific to each temporal construct. The Middle Period, with its close associations to other sites in the Whiskeytown area, appears to represent an "aspect," possibly a community that is linked through intermarriage and kinship (Fredrickson 1994:77-78).

The Middle Mule Pond site has contributed considerably to the development of local prehistory and still has much to offer, both alone and in combination with a suite of neighboring sites that comprise the Swasey National Register Historic Places District.

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APPENDICES

CA-Sha-1544

Applied Attributes for the Lithic Assemblage

Table 4

Artifact Class	unit	level	material	condition	stage/ type	cortex	breaks	flaking pattern	retouch location	retouch shape	edge angle	AL	MW	BW	NW	PSA	DSA	NOA	len/ grid	wid	thk	wt
Debitage:																						
Ident.	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	x	x	x	x
Unident.	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	x	--	--	--
Cores	x	x	x	--	x	x	--	--	--	--	--	--	--	--	--	--	--	--	x	x	x	x
Retouched Tools:																						
Edge-mods	x	x	x	x	x	--	--	--	x	x	x	--	--	--	--	--	--	--	x	x	x	x
Unifaces	x	x	x	x	--	--	--	--	x	x	x	--	--	--	--	--	--	--	x	x	x	x
Bifaces	x	x	x	x	x	--	x	x	--	--	--	--	--	--	--	--	--	--	x	x	x	x
Proj.Pts.	x	x	x	x	x	--	--	--	--	--	--	x	x	x	x	x	x	x	x	x	x	x

AL= Axial length
MW= Maximum width
BW= Basal Width
NW= Neck Width
PSA=Proximal Shoulder Angle

len/grd= length or grid size
wid = width
thk = thickness
wt = weight
NOA =Notch-Opening Angle
DSA=Distal Shoudler Angle

*Refer to Appendix O: Lithic Terminology and Definitions

LITHIC TERMINOLOGY AND DEFINITIONS

Alternate Flake: A flake that is much wider than long, triangular in cross section, and produced as a result of creating a bifacial edge from a square edge on a given piece of stone (Flenniken 1987:52).

Bipolar Flake: A flake which is the product of a reduction strategy in which the parent material receives opposing force to its proximal and distal ends through the use of a percussive instrument and an anvil. Flakes are generally blocky in form, and often exhibit crushed opposable platforms with a sheared bulb of force.

Bulbar Flake: A percussion thinning flake removed from the proximal end of the ventral surface of a flake blank. This flake removes the contact point (platform area), cone, and most of the bulb of percussion from the flake blank (Flenniken 1987:52).

Cobble: Lithic material which exhibits only very minor modification and maintains no less than 99% total cortex.

Early Bifacial Thinning Flake: A percussion flake removed from a biface during secondary reduction activities. These exhibit few dorsal scars, are slightly curved or twisted in long section, have single-faceted or multi-faceted platforms, are usually the largest thinning flakes produced during biface manufacture. These flakes are produced as a result of making large bifaces symmetrical (adapted from Flennekin 1987:52).

Early Stage Core Reduction: A percussion flake removed from a core during primary reduction activities. These exhibit few dorsal scars, are straight in long section, have a single faceted platform which exhibits a smooth, flat, planar surface (Nilsson 1988:glossary).

Early Stage Pressure Flake: A flake removed as part of the first series of pressure flakes taken off a biface. These have multiple scars on their dorsal surface are twisted in long section, are small, and exhibit platforms with oblique angles. These flakes result from regularizing a bifacial edge by pressure flaking (Nilsson 1988:glossary).

Edge Preparation Flake: A flake removed from the edge of a flake blank in order to prepare or rejuvenate the blank for further reduction. The original dorsal surface of the blank serves as the platform of these flakes. The original detachment scar is visible on the distal end of the dorsal surface of these flakes (Flenniken 1987:52).

Edge Removal Flake: These flakes are half-mooned-shaped fragments of a bifacial edge, produced as mistakes when the knapper strikes the biface too hard and too far from the margin (Nilsson 1988:glossary).

Eraillure Flake: An enigmatic flake formed between the bulb of force and the bulbar scar. The eraillure flake, itself, leaves no scar on the core. The dorsal side of the eraillure flake bears no compression rings but the ventral side does bear compression rings that match the scar left on the bulb force (Crabtree 1982:33).

Late Bifacial Thinning Flake: A flake produced during the final stages of percussion flaking. These have numerous scars on their dorsal surfaces, are almost flat in long section, usually exhibit feather terminations, and have multifaceted platforms (Flennekin 1987:54).

Late Stage Core Reduction: A percussion flake removed from a core during primary or secondary reduction activities. These exhibit few dorsal scars, are straight to semi-curved in long section, generally have a single faceted platform which exhibits a smooth, slightly angled planar surface.

Late Stage Pressure Flakes: A flake produced during the final pressure flaking episodes. These are small, parallel-sided flakes with one dorsal arris, are slightly twisted in long section and have multi-faceted, abraded platforms (Nilsson 1988:glossary).

Notch Flake: A pressure flake with the platform situated in a depression and fan-shaped in plan-view. These flakes are produced as a result of manufacturing a notch in a biface (Flenniken 1987:54).

Overshot Flake: (also called Outrepasse) A term that refers to flakes that have their platform as one edge of the biface and the other edge of the flake is the opposite margin of the biface. A flake that travels across the entire biface, from margin to margin (Flenniken 1987:55).

Primary Decortication: A flake which possesses cortex over 100% of its dorsal surface.

Shatter: Angular pieces of material with multiple flake removals that exhibit no distinguishable platforms or terminations.

Unidentifiable Flake Fragments: Flakes with a missing and/or broken platform which renders the platform unrecognizable. A flake is also considered unidentifiable if greater than 50% of its termination is missing.

ATTRIBUTE CODING FORM

IDENTIFIABLE DEBITAGE- CA-Sha-1544

1-4 Unit

6-8 Depth

10-13 Catalog Number

15-16 Material Type:

01	Obsidian
02	Chert
03	Igneous
04	Quartz

18-19 Condition:

01	Complete
02	Incomplete

21-22 Debitage Type:

01	Primary Decortication	10	Edge Preparation
02	Early Core Reduction	11	Edge Removal
03	Late Core Reduction	12	Notching
04	Early Biface Thinning	13	Overshot
05	Late Biface Thinning	14	Angular Shatter
06	Early Pressure	15	Unidentifiable
07	Late Pressure	16	Bipolar
08	Alternate	17	Eraillure
09	Bulbar	18	Cobble

24-27 Length (mm)

29-32 Width (mm)

34-37 Thickness (mm)

39-42 Weight (gm)

44-45 Grid Size (for incomplete and/or angular shatter pieces only)

ATTRIBUTE CODING FORM

UNIDENTIFIABLE DEBITAGE- CA-Sha-1544

1-4	Unit	
6-8	Depth	
10-13	Catalog Number	
15-16	Material Type:	
	01	Obsidian
	02	Chert
	03	Igneous
	04	Quartz
18-19	Grid Size (mm)	

CA-Sha-1544
Middle Mule Pond

Attribute/Metric Statistics
Cores

Catalog #	Unit	Level	Material	Cortex	Type	Len/mm	Wth/mm	Thk/mm	Wht/gm	Remarks
97-0002	vandals/bkdrt NW	none	metavol	1-33%	multiple plat	50.8	47.5	25.6	62.8	
97-0004	vandals/bkdrt NW	none	metavol	1-33%	single plat	59.5	55.3	26.8	88.3	
97-0005	vandals/bkdrt NW	none	metavol	1-33%	multiple plat	102.6	56.3	34.8	277.9	
97-0047	vandals/bkdrt NW	none	obsidian	34-67%	bipolar	28.6	22.1	11.4	6.8	
97-0051	vandals/bkdrt NW	none	metavol	1-33%	multiple plat	64.6	47.3	22.2	76.3	
97-0053	vandals/bkdrt NW	none	metavol	1-33%	multiple plat	71.4	50.9	27.0	97.9	
97-0081	vandals/bkdrt NE	none	obsidian	0%	bipolar	21.8	8.1	5.4	1.2	
97-0118	vandals/bkdrt SW	none	metavol	0%	multiple plat	47.5	23.6	20.3	19.1	
97-0119	vandals/bkdrt SW	none	ccs	1-33%	multiple plat	55.2	33.9	22.8	40.4	
97-0120	vandals/bkdrt SW	none	ccs	0%	multiple plat	49.1	27.1	15.6	30.6	
97-0127	vandals/bkdrt SE	none	metavol	1-33%	multiple plat	90.6	51.8	31.7	185.5	
97-0135	vandals/bkdrt SE	none	obsidian	1-33%	bipolar	16.7	5.7	5.9	0.4	
97-0147	vandals/bkdrt SE	none	ccs	0%	multiple plat	36.9	27.6	20.3	16.6	
97-0162	vandals/bkdrt SE	none	metavol	34-67%	multiple plat	62.3	53.6	16.8	64.0	
97-0176	vandals/bkdrt SE	none	metavol	1-33%	multiple plat	38.9	24.0	13.1	12.0	
97-0177	vandals/bkdrt SE	none	metavol	34-67%	multiple plat	38.6	26.6	17.4	15.7	
97-0179	vandals/bkdrt SE	none	metavol	34-67%	multiple plat	45.7	29.4	14.5	23.9	
97-0182	vandals/rdcut NW	none	metavol	34-67%	multiple plat	127.3	73.5	70.4	731.2	
97-0190	vandals/bkdrt SE	none	obsidian	1-33%	bipolar	18.2	10.2	6.3	1.7	
97-0195	vandals/bkdrt SE	none	obsidian	1-33%	bipolar	23.7	12.0	6.4	2.4	
97-0208	vandals/bkdrt SE	none	ccs	0%	bipolar	40.1	30.2	18.5	23.4	
97-0213	vandals/bkdrt SE	none	metavol	1-33%	multiple plat	47.9	34.1	18.9	27.2	
97-0219	vandals/bkdrt SE	none	obsidian	34-67%	bipolar	25.6	24.3	7.2	3.9	
97-0237	vandals/bkdrt SE	none	metavol	1-33%	single plat	68.3	50.8	25.0	81.5	
97-0284	vandals/bkdrt SE	none	obsidian	1-33%	bipolar	19.5	10.8	10.9	1.9	
97-0336	3s-8w	30-40	metavol	34-67%	multiple plat	71.1	55.9	35.1	153.2	
97-0374	3s-8w	50-60	metavol	0%	multiple plat	53.8	45.0	14.5	51.4	
97-0384	3s-8w	60-70	metavol	0%	multiple plat	48.2	38.3	22.3	51.1	
97-0395	3s-8w	70-80	metavol	1-33%	multiple plat	50.1	49.7	21.6	55.7	
97-0483	3s-8w	120-130	obsidian	0%	bipolar	13.4	13.2	7.4	2.4	
97-0534	3s-8w	160-170	metavol	1-33%	multiple plat	50.7	47.2	22.0	43.9	
97-0566	8s-11e	10-20	metavol	1-33%	multiple plat	54.4	41.9	18.4	62.8	
97-0587	8s-11e	20-30	metavol	34-67%	multiple plat	57.6	46.0	35.3	104.3	
97-0630	8s-11e	50-60	metavol	1-33%	multiple plat	82.0	63.9	33.9	193.4	
97-0705	SE cornr of 8S8W	surface	metavol	34-67%	single plat	70.4	79.0	41.4	269.1	
97-0717	9n-1e	0-10	metavol	0%	multiple plat	49.9	36.4	30.6	59.4	
97-0743	9n-1e	20-30	metavol	1-33%	multiple plat	58.5	49.1	20.4	62.0	
97-0833	9n-1e	80-90	obsidian	1-33%	bipolar	32.5	31.0	15.1	13.0	
97-0921	21n-3e	10-20	metavol	0%	multiple plat	61.2	33.2	13.9	29.0	
97-0943	8s-5e	0-10	metavol	0%	multiple plat	49.7	34.5	16.2	23.4	
97-0990	8s-5e	30-40	ccs	1-33%	single plat	55.7	44.0	24.5	45.7	
97-1087	8s-5e	100-110	metavol	34-67%	single plat	58.0	48.8	39.1	107.6	
97-1172	25s-12e	10-20	obsidian	1-33%	bipolar	26.9	15.3	5.0	2.0	
97-1191	25s-12e	30-40	metavol	34-67%	single plat	107.9	88.7	54.9	681.0	
97-1198	25s-12e	40-50	metavol	0%	multiple plat	51.9	50.1	30.2	78.6	
97-1222	25s-12e	60-70	metavol	0%	multiple plat	44.9	36.4	26.1	46.2	

97-1454	8s-8w	60-70	metavol	0%	multiple plat	50.3	37.6	26.6	42.9	
97-1466	8s-8w	70-80	metavol	68-99%	multiple plat	69.6	63.2	36.9	150.4	
97-1570	8s-8w	140-150	metavol	0%	multiple plat	33.1	27.7	18.2	12.5	exhausted core
97-1571	8s-8w	140-150	metavol	0%	multiple plat	56.2	38.3	30.5	68.8	
97-1572	8s-8w	140-150	ccs	34-67%	multiple plat	52.3	43.9	24.8	50.6	
97-1573	8s-8w	140-150	metavol	1-33%	single plat	66.5	57.4	23.1	100.3	
97-1663	9n-14w	20-30	metavol	1-33%	multiple plat	55.7	35.0	15.6	31.5	
97-1752	9n-14w	80-90	obsidian	1-33%	bipolar	27.3	22.1	15.3	8.5	
97-1773	9n-14w	90-100	ccs	?	multiple plat	54.8	27.9	26.3	45.8	heavy patina
97-1787	9n-14w	100-110	obsidian	0%	bipolar	12.8	13.2	6.5	1.1	
97-1868	17s-12e	30-40	metavol	34-67%	single plat	112.0	98.1	52.7	817.2	
97-1934	7n-8e	60-70	metavol	68-99%	multiple plat	113.0	79.4	65.6	782.9	
97-1935	3s-8w	90-100	ccs	1-33%	multiple plat	185.0	113.9	104.4	2.4	(kg)

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ccs = cryptocrystalline silicate
plat = platform

CA-Sha-1544
Middle Mule Pond

Attribute/Metric Statistics
Edge-Modified Pieces

Catalog	Unit	Level	Mat	Condition	Debitage Type	Retouch Locatn	Retouch Shape	EAngle	Len/mm	Wth/mm	Thk/mm	Wht/gm	Remarks
97-0014	vbkdrt NW	none	obs	complete	late core reduct	lateral/margin	concave	31	18.4	17.4	4.1	0.7	none
97-0015	vbkdrt NW	none	obs	complete	early core reduc	lateral/margin	concave	47	21.4	12.6	5.4	1.2	none
97-0034	vbkdrt NW	none	obs	complete	unidentifiable	unidentifiable	straight	64	23.6	10.3	5.5	1.3	none
97-0058	vbkdrt NW	none	obs	complete	alternate	distal	combination	59	19.3	17.7	8.4	2.6	none
97-0064	vbkdrt NW	none	obs	fragment	late core reduct	lateral/margin	combination	31	(19.5)	18.3	4.1	1.4	none
97-0070	vbkdrt NW	none	ccs	complete	bipolar	lateral/margin	straight	68	25.5	10.6	5.9	1.6	rjvendscr?
97-0079	vbkdrt NE	none	obs	complete	early core reduc	lateral/margin	sinuous	36	17.8	17.6	3.5	0.9	none
97-0085	vbkdrt NE	none	mvl	complete	bulbar	distal	convex	26	24.1	16.9	7.5	2.0	none
97-0087	vbkdrt NE	none	mvl	fragment	early core reduc	combination	convex	33	39.6	(26.2)	10.5	12.4	none
97-0098	vbkdrt NE	none	mvl	complete	early core reduc	lateral/margin	straight	34	40.6	22.2	13.4	12.3	bkd flk
97-0103	vbkdrt SW	none	obs	complete	late core reduct	lateral/margin	straight	44	19.8	14.4	4.2	1.2	none
97-0105	vbkdrt SW	none	obs	complete	primary decortic	lateral/margin	straight	59	30.3	14.9	6.4	2.5	none
97-0107	vbkdrt SW	none	obs	fragment	early core reduc	lateral/margin	straight	64	18.6	(16.5)	4.2	1.7	none
97-0117	vbkdrt SW	none	mvl	fragment	unidentifiable	distal	straight	56	(43.4)	53.6	16.8	22.8	none
97-0121	vbkdrt SW	none	mvl	complete	primary decortic	distal	sinuous	71	74.7	80.8	24.1	187.5	chpprlike
97-0130	vbkdrt SE	none	mvl	complete	early core reduc	distal	convex	53	40.6	36.1	12.0	16.6	none
97-0131	vbkdrt SE	none	obs	fragment	unidentifiable	combination	convex	36	17.9	13.1	5.0	0.8	none
97-0146	vbkdrt SE	none	mvl	complete	late core reduct	lateral/margin	notched	57	54.6	51.1	17.7	37.4	wllwscrpr?
97-0152	vbkdrt SE	none	obs	fragment	unidentifiable	unidentifiable	straight	42	26.4	16.2	5.7	2.2	none
97-0163	vbkdrt SE	none	mvl	complete	early core reduc	lateral/margin	straight	30	56.3	30.0	7.2	11.7	bkd flk
97-0165	vbkdrt SE	none	obs	fragment	bulbar	lateral/margin	straight	64	13.5	16.0	3.0	0.5	none
97-0167	vbkdrt SE	none	mvl	complete	early core reduc	combination	straight	49	41.2	26.5	11.2	11.6	none
97-0180	vbkdrt SE	none	mvl	fragment	late core reduct	combination	sinuous	68	51.6	(37.7)	13.1	24.0	none
97-0191	vbkdrt SE	none	obs	fragment	unidentifiable	combination	convex	69	(17.0)	(14.4)	2.3	0.8	thmnlscrpr
97-0192	vbkdrt SE	none	obs	fragment	unidentifiable	distal	straight	49	14.6	23.6	4.6	1.5	none
97-0196	vbkdrt SE	none	obs	fragment	unidentifiable	combination	convex	49	18.2	14.2	2.3	0.6	none
97-0202	vbkdrt SE	none	mvl	complete	early core reduc	combination	convex	31	50.7	44.4	9.1	22.5	none
97-0204	vbkdrt SE	none	obs	fragment	bulbar	combination	convex	58	(15.9)	13.2	4.1	0.8	none
97-0207	vbkdrt SE	none	mvl	fragment	cobble	combination	convex	66	63.1	33.5	15.1	39.5	chpprlike
97-0210	vbkdrt SE	none	ccs	complete	early core reduc	distal	convex	70	70.0	60.1	19.6	83.4	none
97-0212	vbkdrt SE	none	mvl	complete	late core reduct	lateral/margin	straight	46	36.1	20.6	11.4	8.5	none
97-0214	vbkdrt SE	none	mvl	complete	late core reduct	distal	straight	39	21.0	24.3	10.6	3.4	none
97-0217	vbkdrt SE	none	obs	fragment	alternate	lateral/margin	sinuous	32	(23.1)	17.3	4.4	1.4	none
97-0227	vbkdrt SE	none	obs	fragment	unidentifiable	lateral/margin	straight	33	(13.1)	10.6	2.7	0.4	none
97-0232	vbkdrt SE	none	obs	fragment	unidentifiable	combination	straight	68	(21.5)	22.6	8.0	3.3	none
97-0233	vbkdrt SE	none	obs	fragment	unidentifiable	unidentifiable	straight	55	(13.5)	7.8	4.4	0.4	none
97-0236	vbkdrt SE	none	mvl	complete	primary decortic	combination	convex	69	107.5	57.5	27.9	243.7	chpprlike
97-0247	vbkdrt SE	none	mvl	complete	late core reduct	lateral/margin	straight	69	36.7	28.5	12.7	15.5	none
97-0249	vbkdrt SE	none	obs	fragment	early biface thi	lateral/margin	straight	39	(14.4)	13.4	2.6	0.5	none
97-0252	vbkdrt SE	none	obs	complete	early biface thi	lateral/margin	straight	46	14.3	11.2	2.2	0.4	none
97-0255	vbkdrt SE	none	obs	fragment	late core reduct	lateral/margin	convex	38	(14.1)	13.1	3.9	0.8	none
97-0285	vbkdrt SE	none	obs	complete	late core reduct	combination	convex	36	32.2	19.6	4.9	2.4	none
97-0289	vbkdrt SE	none	mvl	complete	late core reduct	lateral/margin	convex	69	35.5	28.8	7.6	8.2	none
97-0291	vbkdrt SE	none	mvl	fragment	unidentifiable	combination	convex	77	(27.1)	19.3	10.4	5.2	none
97-0292	vbkdrt SE	none	mvl	complete	late core reduct	distal	convex	50	21.5	31.6	5.8	3.8	none
97-0293	vbkdrt SE	none	obs	fragment	bulbar	combination	straight	71	(19.6)	(17.9)	3.2	1.1	none

97-0294	vbkdrt SE	none	obs	fragment	unidentifiable	lateral/margin	straight	41	(16.2)	(11.8)	2.5	0.6	none
97-0302	3s8w	0-10	obs	complete	late core reduct	combination	sinuous	56	26.7	18.1	4.4	1.7	none
97-0303	3s8w	0-10	obs	fragment	late core reduct	combination	straight	46	(13.3)	17.7	2.4	0.6	none
97-0343	3s8w	30-40	obs	complete	early core reduc	distal	concave	58	15.0	31.8	6.5	2.4	none
97-0344	3s8w	30-40	obs	fragment	unidentifiable	unidentifiable	concave	51	20.9	9.0	3.4	0.3	none
97-0345	3s8w	30-40	obs	complete	early core reduc	lateral/margin	straight	56	15.0	11.8	3.7	0.6	none
97-0364	3s8w	50-60	obs	complete	bipolar	lateral/margin	straight	51	22.6	22.3	6.5	2.2	none
97-0365	3s8w	50-60	obs	fragment	unidentifiable	unidentifiable	concave	50	(18.4)	(11.0)	3.8	0.6	none
97-0366	3s8w	50-60	obs	complete	late core reduct	lateral/margin	straight	45	12.9	10.3	1.1	0.2	none
97-0367	3s8w	50-60	obs	fragment	unidentifiable	distal	straight	46	19.3	9.5	4.4	0.5	none
97-0368	3s8w	50-60	obs	fragment	unidentifiable	lateral/margin	straight	32	(13.1)	9.9	1.8	0.2	none
97-0385	3s8w	60-70	obs	fragment	late core reduct	lateral/margin	straight	35	(16.7)	14.0	3.1	0.7	none
97-0386	3s8w	60-70	obs	fragment	unidentifiable	distal	convex	63	13.1	(22.4)	5.0	1.4	none
97-0387	3s8w	60-70	obs	fragment	bipolar	unidentifiable	straight	57	21.2	17.3	4.7	1.6	none
97-0388	3s8w	60-70	obs	fragment	unidentifiable	unidentifiable	straight	49	(10.7)	10.5	2.3	0.2	none
97-0396	3s8w	70-80	ccs	fragment	unidentifiable	lateral/margin	straight	38	(20.0)	15.9	3.3	1.4	none
97-0397	3s8w	70-80	ccs	fragment	unidentifiable	distal	straight	65	(26.2)	23.7	8.2	6.0	none
97-0398	3s8w	70-80	obs	fragment	bulbar	lateral/margin	straight	54	(19.4)	11.6	2.8	0.6	none
97-0399	3s8w	70-80	obs	fragment	unidentifiable	unidentifiable	straight	64	23.2	13.4	6.1	1.5	none
97-0400	3s8w	70-80	obs	fragment	unidentifiable	combination	straight	49	(10.8)	15.0	2.6	0.4	none
97-0409	3s8w	80-90	obs	complete	late core reduct	combination	convex	66	16.2	17.4	2.4	0.7	none
97-0411	3s8w	80-90	obs	fragment	unidentifiable	combination	sinuous	66	(18.1)	9.7	3.4	0.4	none
97-0426	3s8w	90-100	obs	fragment	bipolar	lateral/margin	straight	56	(15.6)	10.6	3.4	0.5	none
97-0427	3s8w	90-100	obs	fragment	unidentifiable	lateral/margin	convex	32	(9.9)	(14.6)	2.0	0.3	none
97-0428	3s8w	90-100	obs	fragment	unidentifiable	unidentifiable	straight	42	(14.6)	8.6	4.4	0.5	none
97-0443	3s8w	100-110	obs	complete	early core reduc	distal	straight	39	9.7	14.9	2.8	0.4	none
97-0445	3s8w	100-110	ccs	fragment	unidentifiable	unidentifiable	convex	83	35.4	(13.4)	10.0	7.2	scrprlike
97-0446	3s8w	100-110	ccs	complete	late core reduct	combination	straight	39	16.8	14.7	4.0	1.1	none
97-0462	3s8w	110-120	obs	fragment	late core reduct	lateral/margin	straight	36	(11.3)	14.2	2.5	0.4	none
97-0463	3s8w	110-120	obs	complete	early core reduc	combination	convex	58	28.7	19.4	7.5	2.8	mhgny crtx
97-0477	3s8w	120-130	obs	fragment	unidentifiable	lateral/margin	straight	51	(26.0)	11.7	7.2	1.1	none
97-0478	3s8w	120-130	obs	complete	bipolar	lateral/margin	convex	50	21.2	9.7	7.2	0.6	none
97-0479	3s8w	120-130	obs	fragment	unidentifiable	lateral/margin	straight	35	(17.4)	13.7	1.9	0.4	none
97-0480	3s8w	120-130	obs	complete	late core reduct	lateral/margin	straight	50	38.2	19.1	5.7	3.0	none
97-0481	3s8w	120-130	obs	fragment	unidentifiable	unidentifiable	concave	54	(15.4)	(7.0)	3.8	0.2	none
97-0482	3s8w	120-130	obs	fragment	unidentifiable	unidentifiable	straight	61	(13.3)	(6.0)	2.4	0.2	none
97-0484	3s8w	120-130	ccs	fragment	unidentifiable	unidentifiable	convex	65	(21.8)	(21.6)	8.3	3.8	none
97-0486	3s8w	120-130	qrtz	fragment	early core reduc	lateral/margin	convex	81	65.1	(41.4)	20.2	83.6	scrpr-like
97-0498	3s8w	130-140	obs	fragment	unidentifiable	unidentifiable	convex	69	(26.4)	10.8	7.3	1.8	unifc-like
97-0500	3s8w	130-140	mvl	fragment	unidentifiable	unidentifiable	convex	59	(18.3)	19.2	3.5	1.4	none
97-0508	3s8w	140-150	mvl	complete	early core reduc	distal	straight	71	49.6	43.9	16.2	38.6	none
97-0509	3s8w	140-150	obs	fragment	unidentifiable	lateral/margin	straight	61	(12.2)	(8.8)	6.3	0.7	none
97-0510	3s8w	140-150	obs	fragment	unidentifiable	unidentifiable	straight	69	(10.5)	(8.7)	3.2	0.3	none
97-0511	3s8w	140-150	obs	complete	bulbar	lateral/margin	convex	61	17.2	15.6	4.7	1.4	none
97-0512	3s8w	140-150	obs	fragment	unidentifiable	combination	convex	55	(17.7)	19.3	4.2	1.5	none
97-0523	3s8w	150-160	ccs	complete	late core reduct	lateral/margin	straight	48	15.5	15.6	4.8	0.9	none
97-0524	3s8w	150-160	obs	fragment	unidentifiable	unidentifiable	straight	44	(11.2)	(8.2)	2.5	0.1	none
97-0533	3s8w	160-170	mvl	fragment	unidentifiable	unidentifiable	straight	68	(29.0)	18.0	8.1	2.9	none
97-0546	8s11e	0-10	obs	complete	bulbar	combination	convex	65	15.7	19.3	3.9	1.0	none
97-0547	8s11e	0-10	obs	fragment	unidentifiable	combination	convex	61	(14.5)	16.7	4.4	1.0	none
97-0548	8s11e	0-10	mvl	fragment	unidentifiable	unidentifiable	sinuous	61	(26.9)	22.2	6.9	3.1	none
97-0561	8s11e	10-20	obs	complete	early core reduc	lateral/margin	concave	52	11.3	18.3	2.8	0.5	none
97-0564	8s11e	10-20	mvl	complete	primary decortic	lateral/margin	straight	45	77.6	62.3	16.5	82.0	none
97-0565	8s11e	10-20	mvl	complete	late core reduct	combination	convex	61	37.5	59.5	18.1	26.3	none
97-0583	8s11e	20-30	obs	fragment	unidentifiable	unidentifiable	straight	76	(17.5)	(8.5)	3.1	0.5	none

97-0584	8s1le	20-30	mvl	fragment	unidentifiable	lateral/margin	straight	44	(45.1)	21.3	5.0	4.2	none
97-0597	8s1le	30-40	mvl	complete	early core reduc	distal	concave	41	29.3	17.4	7.0	3.2	none
97-0598	8s1le	30-40	obs	fragment	unidentifiable	lateral/margin	straight	57	(15.3)	16.7	2.8	1.0	none
97-0599	8s1le	30-40	obs	complete	early core reduc	lateral/margin	straight	57	16.5	10.5	2.8	0.4	none
97-0613	8s1le	40-50	obs	fragment	unidentifiable	combination	convex	78	15.9	(14.7)	3.7	1.0	none
97-0614	8s1le	40-50	obs	complete	bipolar	lateral/margin	convex	75	17.7	12.1	6.1	1.1	none
97-0615	8s1le	40-50	obs	complete	early core reduc	lateral/margin	convex	34	14.5	14.0	4.0	0.7	none
97-0616	8s1le	40-50	mvl	fragment	unidentifiable	lateral/margin	straight	46	(34.9)	14.3	4.8	2.6	none
97-0627	8s1le	50-60	obs	complete	primary decortic	lateral/margin	straight	54	21.0	12.2	5.3	1.6	none
97-0637	8s1le	60-70	mvl	complete	late core reduct	distal	convex	29	63.3	68.0	9.2	40.9	none
97-0638	8s1le	60-70	obs	fragment	late core reduct	lateral/margin	straight	38	23.2	(7.7)	4.0	0.6	none
97-0639	8s1le	60-70	obs	fragment	primary decortic	lateral/margin	straight	42	22.8	(15.6)	5.7	1.6	bipolared
97-0640	8s1le	60-70	obs	fragment	unidentifiable	unidentifiable	concave	58	(11.9)	(8.9)	3.4	0.3	none
97-0659	8s1le	70-80	obs	fragment	unidentifiable	combination	convex	49	(24.4)	17.0	3.2	1.2	none
97-0660	8s1le	70-80	obs	fragment	bipolar	lateral/margin	straight	60	(18.5)	16.5	5.8	1.2	none
97-0661	8s1le	70-80	obs	fragment	unidentifiable	unidentifiable	straight	50	(10.6)	(8.6)	2.1	0.2	none
97-0662	8s1le	70-80	mvl	fragment	unidentifiable	unidentifiable	straight	68	(30.6)	(26.4)	14.8	11.7	none
97-0673	8s1le	80-90	mvl	fragment	primary decortic	combination	convex	63	60.7	(49.3)	15.0	59.2	none
97-0674	8s1le	80-90	mvl	fragment	unidentifiable	unidentifiable	sinuous	47	(21.4)	(9.6)	3.0	0.6	none
97-0675	8s1le	80-90	obs	fragment	unidentifiable	unidentifiable	convex	69	(15.8)	(7.2)	3.5	0.3	none
97-0676	8s1le	80-90	obs	fragment	unidentifiable	lateral/margin	straight	44	(12.8)	15.9	1.9	0.4	none
97-0677	8s1le	80-90	obs	fragment	late core reduct	lateral/margin	convex	64	(16.2)	18.6	5.4	1.5	none
97-0689	8s1le	90-100	mvl	fragment	unidentifiable	unidentifiable	straight	54	(17.3)	(11.9)	6.3	1.3	none
97-0706	surface	SW/9N1E	mvl	complete	primary decortic	combination	convex	39	86.2	117.7	23.1	183.1	none
97-0708	surface	offsite	mvl	complete	early core reduc	distal	convex	72	76.7	92.2	24.6	167.7	none
97-0709	surface	offsite	qrtz	complete	primary decortic	distal	convex	78	15.9	35.7	8.3	5.9	none
97-0716	9n1e	0-10	mvl	complete	early core reduc	distal	convex	73	47.4	37.1	15.2	27.5	none
97-0729	9n1e	10-20	obs	complete	early core reduc	distal	convex	49	21.6	14.4	5.1	1.2	none
97-0739	9n1e	20-30	obs	complete	early core reduc	lateral/margin	straight	69	16.5	10.6	4.4	0.7	none
97-0740	9n1e	20-30	obs	fragment	unidentifiable	lateral/margin	straight	63	13.6	9.4	4.6	0.5	none
97-0752	9n1e	30-40	obs	complete	early core reduc	combination	convex	68	18.2	15.4	4.4	1.0	none
97-0761	9n1e	40-50	obs	complete	early biface thi	lateral/margin	concave	50	13.8	9.6	2.1	0.2	none
97-0762	9n1e	40-50	obs	fragment	unidentifiable	distal	straight	47	(7.7)	(7.5)	2.1	0.1	none
97-0763	9n1e	40-50	obs	complete	early core reduc	lateral/margin	sinuous	55	19.4	8.3	3.9	0.4	none
97-0764	9n1e	40-50	obs	complete	early core reduc	combination	straight	61	13.4	17.2	4.3	0.9	none
97-0781	9n1e	50-60	mvl	complete	late core reduct	distal	convex	68	30.7	26.8	9.1	5.1	none
97-0782	9n1e	50-60	obs	complete	early core reduc	lateral/margin	sinuous	61	24.9	16.1	4.6	1.6	none
97-0783	9n1e	50-60	obs	complete	bulbar	lateral/margin	sinuous	68	14.0	16.2	3.4	0.8	none
97-0784	9n1e	50-60	obs	fragment	unidentifiable	unidentifiable	straight	52	(11.2)	8.0	4.0	0.2	none
97-0796	9n1e	60-70	mvl	complete	early core reduc	lateral/margin	straight	41	45.9	17.9	7.8	4.7	heat trt
97-0797	9n1e	60-70	obs	complete	late core reduct	lateral/margin	convex	64	14.7	13.4	2.0	0.5	none
97-0798	9n1e	60-70	obs	fragment	unidentifiable	unidentifiable	sinuous	63	(16.0)	(11.5)	2.3	0.6	none
97-0830	9n1e	80-90	obs	fragment	unidentifiable	unidentifiable	concave	71	(24.5)	(14.3)	5.6	1.6	bipolr mod
97-0831	9n1e	80-90	obs	fragment	bulbar	lateral/margin	straight	43	(14.9)	18.4	4.3	1.2	none
97-0832	9n1e	80-90	obs	fragment	unidentifiable	lateral/margin	straight	45	(14.4)	12.0	2.8	0.4	none
97-0840	9n1e	90-100	obs	fragment	unidentifiable	lateral/margin	sinuous	61	(22.5)	14.4	2.7	0.8	none
97-0841	9n1e	90-100	obs	complete	late core reduct	lateral/margin	concave	63	19.2	11.6	3.3	0.7	none
97-0842	9n1e	90-100	obs	complete	early core reduc	lateral/margin	convex	46	20.5	24.7	7.9	4.0	none
97-0843	9n1e	90-100	obs	complete	early core reduc	lateral/margin	convex	46	27.6	20.3	6.5	2.9	none
97-0853	9n1e	100-110	mvl	complete	early core reduc	lateral/margin	straight	43	30.9	22.4	4.7	3.0	none
97-0865	9n1e	110-120	obs	complete	late core reduct	lateral/margin	straight	52	36.1	25.7	7.5	6.1	none
97-0866	9n1e	110-120	obs	fragment	unidentifiable	combination	convex	50	(13.4)	10.0	2.4	0.3	none
97-0868	9n1e	110-120	ccs	complete	late core reduct	distal	concave	82	38.0	37.5	14.1	20.9	none
97-0879	9n1e	120-130	mvl	complete	early core reduc	lateral/margin	sinuous	64	53.3	79.0	24.7	113.6	bipolr mod
97-0881	9n1e	120-130	obs	complete	early biface thi	lateral/margin	straight	50	13.5	9.7	3.0	0.3	none

97-0882	9n1e	120-130	obs	fragment	unidentifiable	lateral/margin	notched	48	(14.3)	(8.9)	3.3	0.3	none
97-0902	9n1e	150-160	mvl	complete	late core reduct	combination	sinuous	70	55.6	55.2	13.4	57.6	none
97-0911	21n3e	0-10	obs	fragment	unidentifiable	combination	convex	69	(15.6)	10.8	2.8	0.4	none
97-0918	21n3e	10-20	mvl	fragment	late core reduct	lateral/margin	convex	42	47.0	(49.2)	10.9	19.6	none
97-0919	21n3e	10-20	mvl	complete	early core reduc	lateral/margin	convex	31	22.7	38.3	5.7	5.3	none
97-0920	21n3e	10-20	obs	fragment	bulbar	combination	concave	59	17.8	(22.9)	4.4	1.4	none
97-0932	21n3e	30-40	obs	fragment	unidentifiable	lateral/margin	concave	44	(14.8)	12.6	3.1	0.5	none
97-0941	8s5e	0-10	obs	complete	late core reduct	combination	sinuous	56	24.3	15.1	4.7	1.5	none
97-0942	8s5e	0-10	mvl	fragment	unidentifiable	combination	sinuous	76	52.9	(41.3)	14.8	41.9	none
97-0955	8s5e	10-20	mvl	fragment	unidentifiable	combination	convex	69	(57.9)	40.3	20.6	35.7	none
97-0956	8s5e	10-20	mvl	fragment	unidentifiable	unidentifiable	straight	60	23.9	26.6	9.0	5.4	none
97-0972	8s5e	20-30	obs	fragment	unidentifiable	distal	straight	54	(17.2)	20.5	6.7	1.5	none
97-0973	8s5e	20-30	obs	complete	late core reduct	lateral/margin	straight	55	19.9	10.1	3.5	0.5	none
97-0974	8s5e	20-30	obs	complete	late core reduct	lateral/margin	straight	66	18.2	11.8	5.5	0.7	none
97-0975	8s5e	20-30	obs	fragment	unidentifiable	combination	convex	71	(10.1)	19.3	2.1	0.5	none
97-0978	8s5e	20-30	mvl	complete	early core reduc	lateral/margin	straight	61	63.0	47.4	16.1	42.0	none
97-0988	8s5e	30-40	obs	fragment	unidentifiable	lateral/margin	straight	44	(17.3)	12.6	3.6	0.5	none
97-1013	8s5e	50-60	mvl	complete	early core reduc	lateral/margin	straight	51	43.0	28.1	6.5	7.3	none
97-1016	8s5e	50-60	obs	complete	late biface thin	lateral/margin	sinuous	46	21.2	9.7	3.1	0.5	none
97-1017	8s5e	50-60	obs	fragment	unidentifiable	lateral/margin	straight	63	(15.3)	(8.7)	3.7	0.5	none
97-1018	8s5e	50-60	obs	fragment	unidentifiable	distal	straight	48	18.6	(13.0)	2.9	0.8	none
97-1019	8s5e	50-60	obs	complete	early core reduc	combination	convex	48	19.2	22.3	4.5	1.5	none
97-1020	8s5e	50-60	obs	fragment	unidentifiable	unidentifiable	straight	45	(22.9)	(12.7)	3.5	0.7	none
97-1055	8s5e	90-100	obs	complete	early biface thi	lateral/margin	straight	66	19.3	8.0	2.9	0.3	none
97-1056	8s5e	90-100	obs	complete	late biface thin	lateral/margin	sinuous	53	28.9	15.9	4.6	1.4	none
97-1057	8s5e	90-100	obs	complete	early core reduc	lateral/margin	convex	60	19.4	16.6	3.4	1.2	none
97-1058	8s5e	90-100	obs	fragment	unidentifiable	combination	straight	47	(44.7)	(8.1)	8.1	3.2	none
97-1059	8s5e	90-100	obs	fragment	unidentifiable	combination	convex	60	(18.1)	16.7	2.9	0.9	none
97-1060	8s5e	90-100	obs	fragment	unidentifiable	combination	convex	61	(17.4)	(11.6)	3.9	0.8	none
97-1061	8s5e	90-100	obs	complete	early core reduc	lateral/margin	sinuous	49	10.3	17.0	3.8	0.5	none
97-1079	8s5e	100-110	obs	complete	late core reduct	combination	straight	58	30.5	17.0	8.0	4.7	none
97-1080	8s5e	100-110	obs	fragment	unidentifiable	lateral/margin	straight	66	(15.0)	(9.3)	4.3	0.5	none
97-1081	8s5e	100-110	obs	fragment	unidentifiable	combination	concave	56	(23.9)	10.0	3.5	0.5	none
97-1082	8s5e	100-110	obs	complete	early core reduc	combination	convex	54	18.7	24.2	5.5	1.7	none
97-1083	8s5e	100-110	mvl	complete	late core reduct	combination	straight	48	44.4	85.0	13.8	60.5	none
97-1084	8s5e	100-110	mvl	complete	early core reduc	combination	sinuous	65	42.2	46.0	16.2	36.9	none
97-1085	8s5e	100-110	mvl	fragment	early core reduc	combination	sinuous	59	31.6	(42.7)	7.2	9.1	none
97-1101	8s5e	110-120	obs	fragment	unidentifiable	unidentifiable	straight	66	(26.6)	(13.7)	9.0	2.6	none
97-1102	8s5e	110-120	obs	complete	late core reduct	lateral/margin	sinuous	55	19.5	12.4	5.0	1.0	none
97-1103	8s5e	110-120	obs	complete	late core reduct	combination	convex	64	13.0	14.2	3.7	0.8	none
97-1104	8s5e	110-120	obs	fragment	unidentifiable	unidentifiable	concave	62	(17.5)	(10.8)	4.6	0.8	none
97-1105	8s5e	110-120	obs	fragment	unidentifiable	unidentifiable	convex	38	(15.4)	(5.9)	2.9	0.2	none
97-1106	8s5e	110-120	obs	complete	early core reduc	lateral/margin	straight	52	11.5	13.5	2.7	0.3	none
97-1107	8s5e	110-120	obs	complete	bipolar	lateral/margin	straight	49	26.4	13.8	6.8	2.8	bipolr mod
97-1121	8s5e	120-130	obs	fragment	unidentifiable	unidentifiable	straight	53	(17.2)	(12.4)	5.6	1.0	bipolr mod
97-1122	8s5e	120-130	obs	complete	bipolar	lateral/margin	straight	62	12.3	11.2	4.7	0.6	none
97-1123	8s5e	120-130	obs	fragment	unidentifiable	proximal	convex	53	12.8	(11.1)	2.8	0.4	none
97-1133	8s5e	130-140	obs	fragment	unidentifiable	lateral/margin	straight	65	(7.5)	(12.1)	6.2	0.4	none
97-1139	8s5e	140-150	obs	fragment	unidentifiable	combination	convex	55	(24.4)	14.9	5.5	1.5	none
97-1150	25s12e	0-10	obs	complete	early core reduc	combination	convex	52	14.2	11.6	2.5	0.5	none
97-1151	25s12e	0-10	obs	complete	early core reduc	combination	straight	52	17.8	17.8	5.8	1.7	none
97-1152	25s12e	0-10	mvl	fragment	unidentifiable	unidentifiable	straight	62	(27.9)	41.6	14.5	17.0	none
97-1170	25s12e	10-20	obs	fragment	unidentifiable	unidentifiable	sinuous	60	(15.4)	(11.5)	3.6	0.7	none
97-1171	25s12e	10-20	obs	fragment	late core reduct	lateral/margin	straight	48	(10.5)	8.7	2.2	0.2	none
97-1178	25s12e	20-30	obs	fragment	unidentifiable	lateral/margin	straight	52	(17.8)	14.4	3.7	0.8	none

97-1187	25s12e	30-40	obs	fragment	unidentifiable	unidentifiable	straight	52	17.8	9.6	4.4	0.8	bipolr mod
97-1190	25s12e	30-40	mvl	complete	primary decortic	lateral/margin	notched	69	66.4	52.0	12.2	57.5	striations
97-1209	25s12e	50-60	mvl	complete	early core reduc	combination	convex	54	22.1	18.4	4.8	1.9	none
97-1217	25s12e	60-70	obs	fragment	unidentifiable	distal	straight	53	12.0	(15.8)	2.7	0.5	none
97-1218	25s12e	60-70	obs	fragment	unidentifiable	combination	straight	53	(18.2)	(10.4)	2.8	0.4	none
97-1219	25s12e	60-70	obs	complete	bipolar	lateral/margin	straight	76	9.9	12.5	3.8	0.4	none
97-1238	7n8e	0-10	obs	complete	bipolar	lateral/margin	convex	66	23.6	15.4	8.0	2.4	none
97-1247	7n8e	10-20	mvl	complete	early core reduc	lateral/margin	convex	55	65.6	61.6	18.3	74.5	none
97-1271	7n8e	30-40	obs	fragment	unidentifiable	unidentifiable	straight	69	(26.4)	(12.1)	9.6	2.4	bipolr mod
97-1271	7n8e	30-40	mvl	complete	early core reduc	combination	straight	73	50.0	52.3	21.5	64.2	none
97-1272	7n8e	30-40	mvl	fragment	unidentifiable	unidentifiable	straight	42	(32.8)	15.7	6.8	3.0	none
97-1274	7n8e	30-40	obs	fragment	unidentifiable	unidentifiable	straight	62	22.7	17.3	11.0	3.5	none
97-1297	7n8e	50-60	obs	complete	late core reduct	lateral/margin	straight	48	13.2	21.2	3.3	0.8	none
97-1298	7n8e	50-60	obs	fragment	unidentifiable	combination	concave	36	(18.9)	8.8	2.2	0.2	none
97-1311	7n8e	60-70	obs	fragment	unidentifiable	unidentifiable	straight	60	(20.7)	(17.1)	7.6	2.1	none
97-1328	7n8e	80-90	obs	fragment	unidentifiable	lateral/margin	straight	58	(10.2)	10.0	2.4	0.2	none
97-1329	7n8e	80-90	obs	fragment	bipolar	combination	convex	65	(15.3)	22.9	4.6	1.4	none
97-1340	7n8e	90-100	obs	complete	late core reduct	lateral/margin	sinuous	44	20.5	18.9	6.7	2.1	none
97-1341	7n8e	90-100	obs	fragment	unidentifiable	lateral/margin	convex	59	(12.2)	13.4	1.5	0.4	none
97-1349	7n8e	100-110	mvl	complete	late core reduct	lateral/margin	straight	59	23.2	33.9	9.0	6.5	none
97-1350	7n8e	100-110	obs	fragment	unidentifiable	unidentifiable	straight	65	(21.7)	(15.4)	7.1	2.0	none
97-1351	7n8e	100-110	obs	fragment	edge removal	combination	straight	49	(9.0)	8.9	2.1	0.1	none
97-1368	8s8w	0-10	obs	fragment	unidentifiable	lateral/margin	convex	69	(15.0)	(9.8)	6.1	0.7	none
97-1369	8s8w	0-10	obs	complete	early core reduc	lateral/margin	concave	43	19.6	16.1	5.9	0.9	none
97-1372	8s8w	0-10	mvl	fragment	unidentifiable	combination	convex	78	(35.6)	(30.7)	20.0	19.2	none
97-1373	8s8w	0-10	mvl	fragment	unidentifiable	lateral/margin	straight	56	(23.3)	30.8	6.6	5.4	none
97-1386	8s8w	10-20	obs	fragment	unidentifiable	lateral/margin	straight	60	(23.7)	24.4	9.7	5.3	none
97-1396	8s8w	20-30	obs	complete	late core reduct	lateral/margin	straight	51	29.0	18.5	2.5	1.2	none
97-1409	8s8w	30-40	obs	complete	late core reduct	lateral/margin	straight	42	17.0	9.9	4.2	0.6	none
97-1410	8s8w	30-40	obs	fragment	unidentifiable	unidentifiable	straight	54	15.3	14.6	5.5	1.0	none
97-1426	8s8w	40-50	obs	complete	early core reduc	lateral/margin	straight	49	12.4	21.0	3.0	0.6	none
97-1440	8s8w	50-60	obs	complete	early core reduc	lateral/margin	straight	56	14.5	13.8	3.0	0.5	none
97-1449	8s8w	60-70	obs	fragment	unidentifiable	lateral/margin	straight	50	(11.0)	10.6	2.5	0.4	none
97-1450	8s8w	60-70	obs	complete	early core reduc	lateral/margin	concave	44	15.8	22.6	2.4	0.6	none
97-1465	8s8w	70-80	mvl	complete	early core reduc	lateral/margin	sinuous	44	26.0	34.1	9.2	7.4	none
97-1478	8s8w	80-90	obs	fragment	unidentifiable	distal	straight	36	(9.6)	15.1	2.3	0.2	none
97-1505	8s8w	100-110	obs	complete	late core reduct	combination	straight	51	13.1	12.8	3.2	0.5	none
97-1516	8s8w	110-120	obs	fragment	unidentifiable	combination	convex	81	18.1	(15.1)	4.3	1.2	scrpr-like
97-1517	8s8w	110-120	obs	complete	early core reduc	lateral/margin	sinuous	46	17.4	19.0	2.6	0.9	none
97-1530	8s8w	120-130	obs	fragment	unidentifiable	unidentifiable	straight	79	(15.1)	(8.4)	2.3	0.4	none
97-1531	8s8w	120-130	obs	fragment	unidentifiable	distal	sinuous	49	(17.0)	10.6	2.5	0.5	none
97-1532	8s8w	120-130	ccs	fragment	unidentifiable	unidentifiable	straight	62	(14.7)	(14.6)	1.9	0.4	none
97-1533	8s8w	120-130	mvl	fragment	unidentifiable	lateral/margin	sinuous	51	(15.9)	25.2	6.3	2.2	none
97-1534	8s8w	120-130	mvl	complete	early core reduc	lateral/margin	straight	69	62.9	36.9	7.9	30.8	none
97-1535	8s8w	120-130	mvl	complete	early core reduc	lateral/margin	straight	62	75.4	53.5	23.6	109.5	none
97-1547	8s8w	130-140	obs	fragment	unidentifiable	unidentifiable	convex	57	(20.0)	(13.1)	4.1	1.0	none
97-1548	8s8w	130-140	obs	fragment	unidentifiable	unidentifiable	straight	43	(27.1)	(15.7)	4.3	1.4	none
97-1549	8s8w	130-140	mvl	fragment	unidentifiable	unidentifiable	straight	50	24.3	44.1	15.6	16.1	none
97-1551	8s8w	130-140	obs	fragment	unidentifiable	unidentifiable	convex	64	9.2	9.1	5.3	0.4	none
97-1567	8s8w	140-150	mvl	complete	late core reduct	lateral/margin	straight	59	45.1	41.2	11.7	24.2	mod oncrtx
97-1586	8s8w	150-160	obs	fragment	unidentifiable	unidentifiable	concave	61	14.7	12.7	7.2	1.1	none
97-1587	8s8w	150-160	obs	fragment	late core reduct	combination	convex	61	(11.0)	14.8	3.3	0.6	none
97-1588	8s8w	150-160	obs	fragment	unidentifiable	lateral/margin	convex	56	(14.5)	7.5	2.6	0.3	none
97-1604	8s8w	160-170	obs	fragment	unidentifiable	unidentifiable	convex	69	(10.2)	(7.1)	3.9	0.3	none
97-1617	8s8w	170-180	obs	fragment	unidentifiable	unidentifiable	convex	79	(18.3)	(10.8)	3.0	0.7	none

97-1618	8s8w	170-180	obs	fragment	unidentifiable	combination	convex	68	(24.0)	14.1	2.6	0.9	none
97-1619	8s8w	170-180	obs	fragment	unidentifiable	unidentifiable	concave	61	(13.7)	(13.1)	3.3	0.5	none
97-1627	8s8w	180-190	mvl	complete	late core reduct	combination	straight	68	18.0	26.8	2.8	1.4	none
97-1637	9n14w	0-10	obs	fragment	early biface thi	lateral/margin	concave	62	(14.9)	13.7	3.4	0.7	none
97-1649	9n14w	10-20	obs	fragment	unidentifiable	distal	straight	44	11.3	(16.0)	2.7	0.2	none
97-1650	9n14w	10-20	obs	complete	early core reduc	lateral/margin	straight	58	23.3	14.6	6.0	1.2	none
97-1651	9n14w	10-20	obs	fragment	unidentifiable	combination	convex	51	(11.8)	14.7	2.5	0.5	none
97-1664	9n14w	20-30	obs	fragment	unidentifiable	combination	concave	59	(22.9)	(15.1)	4.7	0.8	none
97-1691	9n14w	40-50	obs	complete	late core reduct	lateral/margin	straight	46	24.4	10.8	4.2	0.8	none
97-1692	9n14w	40-50	obs	fragment	angular shatter	unidentifiable	straight	56	(18.3)	10.1	5.5	0.8	none
97-1693	9n14w	40-50	obs	complete	early core reduc	combination	sinuous	54	17.7	10.1	4.4	0.7	none
97-1694	9n14w	40-50	obs	fragment	unidentifiable	lateral/margin	straight	69	30.8	(8.9)	6.6	1.3	none
97-1695	9n14w	40-50	obs	complete	early core reduc	lateral/margin	concave	43	18.7	16.3	5.1	1.1	none
97-1696	9n14w	40-50	obs	fragment	unidentifiable	lateral/margin	straight	61	(20.9)	14.4	3.4	1.0	none
97-1710	9n14w	50-60	obs	complete	early core reduc	lateral/margin	straight	55	23.4	11.4	3.8	0.9	none
97-1720	9n14w	60-70	obs	complete	bipolar	lateral/margin	concave	41	14.8	10.2	2.9	0.3	none
97-1721	9n14w	60-70	obs	fragment	unidentifiable	unidentifiable	convex	54	(8.6)	(7.9)	3.3	0.2	none
97-1722	9n14w	60-70	obs	fragment	unidentifiable	lateral/margin	concave	52	(13.8)	13.0	2.8	0.3	none
97-1723	9n14w	60-70	obs	fragment	unidentifiable	combination	straight	49	(15.1)	(12.7)	1.7	0.5	none
97-1724	9n14w	60-70	obs	fragment	unidentifiable	combination	convex	52	(12.1)	12.0	3.0	0.4	none
97-1725	9n14w	60-70	obs	complete	late core reduct	lateral/margin	sinuous	45	22.5	19.6	5.9	1.3	none
97-1726	9n14w	60-70	mvl	fragment	unidentifiable	lateral/margin	straight	42	(23.0)	16.0	4.7	1.6	none
97-1739	9n14w	70-80	obs	complete	early core reduc	lateral/margin	straight	73	10.3	5.7	2.0	0.1	none
97-1740	9n14w	70-80	mvl	fragment	unidentifiable	combination	straight	44	(25.8)	43.3	9.6	8.4	none
97-1750	9n14w	80-90	obs	complete	bipolar	unidentifiable	sinuous	48	12.3	14.7	5.1	0.6	bipolr mod
97-1751	9n14w	80-90	obs	fragment	unidentifiable	unidentifiable	sinuous	62	(11.9)	(5.2)	1.8	0.1	none
97-1753	9n14w	80-90	ccs	fragment	unidentifiable	unidentifiable	convex	79	(19.6)	(5.5)	5.6	0.7	scrpr frag
97-1770	9n14w	90-100	obs	complete	early core reduc	lateral/margin	concave	63	18.2	11.7	5.4	1.0	bipolr mod
97-1771	9n14w	90-100	obs	complete	early core reduc	lateral/margin	concave	48	19.6	11.6	3.7	0.8	bipolr mod
97-1772	9n14w	90-100	mvl	complete	early core reduc	combination	convex	64	35.5	35.4	12.7	18.3	none
97-1786	9n14w	100-110	obs	fragment	unidentifiable	unidentifiable	convex	66	(7.8)	(6.2)	2.8	0.1	none
97-1788	9n14w	100-110	obs	complete	bulbar	combination	convex	59	12.8	16.6	2.4	0.5	none
97-1789	9n14w	100-110	mvl	fragment	late core reduct	combination	convex	65	(47.5)	50.4	19.6	54.0	none
97-1810	9n14w	120-130	obs	fragment	unidentifiable	lateral/margin	straight	55	24.7	14.9	6.5	1.4	none
97-1811	9n14w	120-130	mvl	fragment	unidentifiable	unidentifiable	concave	78	(45.9)	(34.3)	11.7	19.4	none
97-1820	17s12e	0-10	obs	complete	early core reduc	lateral/margin	convex	54	25.4	17.8	4.1	1.6	none
97-1821	17s12e	0-10	obs	complete	early core reduc	lateral/margin	straight	50	23.3	10.4	4.5	0.8	none
97-1822	17s12e	0-10	obs	fragment	unidentifiable	lateral/margin	convex	65	(16.9)	16.8	3.7	0.7	none
97-1831	17s12e	10-20	obs	fragment	unidentifiable	lateral/margin	straight	60	(12.5)	7.9	2.8	0.3	none
97-1832	17s12e	10-20	obs	fragment	early core reduc	combination	straight	75	(16.9)	29.1	7.7	4.0	bipolr mod
97-1833	17s12e	10-20	mvl	fragment	unidentifiable	unidentifiable	straight	62	(49.9)	25.8	19.1	11.0	none
97-1849	17s12e	20-30	obs	complete	bipolar	lateral/margin	convex	56	15.4	15.9	5.4	1.0	none
97-1850	17s12e	20-30	obs	fragment	unidentifiable	distal	convex	46	(12.9)	(11.4)	3.2	0.3	none
97-1851	17s12e	20-30	ccs	fragment	unidentifiable	lateral/margin	convex	56	(18.0)	27.2	8.2	3.0	none
97-1852	17s12e	20-30	mvl	fragment	unidentifiable	combination	straight	52	(24.0)	28.0	12.6	9.2	none
97-1865	17s12e	30-40	obs	fragment	unidentifiable	unidentifiable	straight	60	(19.1)	(16.2)	4.4	1.4	none
97-1878	17s12e	40-50	mvl	complete	late core reduct	lateral/margin	straight	62	51.1	21.4	10.9	9.8	bcked flk
97-1879	17s12e	40-50	obs	complete	bipolar	unidentifiable	straight	59	7.7	20.0	6.0	1.0	none
97-1889	17s12e	50-60	mvl	complete	late core reduct	lateral/margin	convex	55	39.5	17.2	4.5	4.3	mod oncrtx
97-1890	17s12e	50-60	mvl	fragment	unidentifiable	unidentifiable	sinuous	53	(24.2)	(19.7)	8.4	3.1	none

CA-Sha-1544
Middle Mule Pond

Attribute/Metric Statistics
Bifaces

Cat.No.	Unit	Level	Material	Condition	Breaks	Flaking_Pat	Type	Len/mm	Wid/mm	Thk/mm	Wht/gm	Remarks
97-0010	vbkdrt	NW none	obsidian	unidentifiable	transverse	unpatterned	2-shaping	(18.01)	18.96	8.59	3.0	none
97-0018	vbkdrt	NW none	obsidian	distal	transverse	unpatterned	2-shaping	(21.81)	19.24	5.85	1.6	none
97-0021	vbkdrt	NW none	obsidian	complete	none	unpatterned	3-thinning	24.53	14.62	4.53	1.4	preform-like
97-0024	vbkdrt	NW none	obsidian	distal	transverse	unpatterned	3-thinning	(14.67)	8.37	2.67	0.4	none
97-0041	vbkdrt	NW none	obsidian	unidentifiable	transverse	unpatterned	3-thinning	(15.81)	23.05	4.43	1.9	none
97-0046	vbkdrt	NW none	obsidian	complete	none	unpatterned	3-thinning	23.52	16.96	4.57	1.9	bipolared
97-0054	vbkdrt	NW none	obsidian	unidentifiable	transverse	unpatterned	2-shaping	(15.26)	13.33	4.90	1.1	bipolared
97-0055	vbkdrt	NW none	obsidian	midsection	transverse	unpatterned	2-shaping	(24.31)	20.94	7.71	4.4	none
97-0061	vbkdrt	NW none	obsidian	unidentifiable	transverse	unpatterned	3-thinning	(11.42)	13.35	3.95	0.5	bip cortex
97-0065	vbkdrt	NW none	obsidian	dis/prox	transverse	unpatterned	3-thinning	(27.35)	16.23	4.34	1.5	none
97-0066	vbkdrt	NW none	obsidian	dis/prox	transverse	unpatterned	2-shaping	(17.05)	13.31	6.04	1.3	none
97-0080	vbkdrt	NE none	obsidian	dis/prox	transverse	unpatterned	3-thinning	(19.22)	16.48	6.72	1.8	crtx on end
97-0104	vbkdrt	SW none	obsidian	complete	none	unpatterned	3-thinning	23.70	20.38	4.42	2.0	crtx present
97-0136	vbkdrt	SE none	ccs	distal	transverse	patterned	4-press flked	(14.09)	11.49	4.98	0.8	none
97-0193	vbkdrt	SE none	obsidian	dis/prox	perverse	patterned	4-press flked	16.40	9.47	5.08	0.7	none
97-0216	vbkdrt	SE none	ccs	unidentifiable	transverse	unpatterned	2-shaping	(16.42)	20.32	8.31	2.3	none
97-0231	vbkdrt	SE none	obsidian	proximal	transverse	patterned	3-thinning	(17.31)	15.71	4.57	0.8	none
97-0261	vbkdrt	SE none	obsidian	distal	transverse	patterned	3-thinning	(11.23)	9.05	3.41	0.3	none
97-0267	vbkdrt	SE none	obsidian	complete	none	unpatterned	2-shaping	15.99	14.34	4.20	0.7	none
97-0268	vbkdrt	SE none	obsidian	complete	none	unpatterned	2-shaping	19.85	15.09	5.10	1.3	preform-like
97-0311	3s8w	10-20	obsidian	dis/prox	transverse	unpatterned	1-roughout	(21.28)	21.55	5.66	2.5	none
97-0334	3s8w	30-40	obsidian	distal	transverse	unpatterned	3-thinning	(12.07)	8.04	2.18	0.1	none
97-0342	3s8w	30-40	obsidian	dis/prox	transverse	unpatterned	3-thinning	(14.62)	22.51	2.88	1.1	none
97-356	3s8w	40-50	obsidian	dis/prox	transverse	unpatterned	2-shaping	(15.91)	19.40	9.54	1.9	crtx present
97-0410	3s8w	80-90	obsidian	distal	transverse	unpatterned	2-shaping	(7.70)	8.94	5.06	0.3	none
97-0442	3s8w	100-110	obsidian	unidentifiable	transverse	unpatterned	2-shaping	(8.08)	16.33	6.53	0.7	none
97-0464	3s8w	110-120	obsidian	dis/prox	transverse	unpatterned	2-shaping	(8.25)	9.70	4.15	0.2	heat treated
97-0465	3s8w	110-120	ccs	lateral	long.split	unpatterned	2-shaping	15.33	(13.47)	8.14	1.7	none
97-0485	3s8w	120-130	ccs	dis/prox	transverse	unpatterned	2-shaping	(10.02)	11.48	3.78	0.4	none
97-0499	3s8w	130-140	obsidian	proximal	transverse	unpatterned	3-thinning	(17.74)	17.41	4.61	1.2	none
97-0513	3s8w	140-150	ccs	proximal	transverse	unpatterned	2-shaping	(15.78)	16.37	9.13	2.5	pt base??
97-0514	3s8w	140-150	ccs	midsection	transverse	unpatterned	2-shaping	(10.22)	18.12	9.24	1.8	pt midsctn
97-0515	3s8w	140-150	obsidian	dis/prox	transverse	unpatterned	2-shaping	(10.95)	13.88	3.16	0.4	none
97-0585	8s11e	20-30	obsidian	midsection	transverse	unpatterned	2-shaping	(6.82)	11.88	3.75	0.3	none
97-0586	8s11e	20-30	obsidian	midsection	transverse	patterned	4-press flked	(14.40)	10.87	3.56	0.4	serrated
97-0600	8s11e	30-40	obsidian	unidentifiable	transverse	unpatterned	1-roughout	(10.36)	10.87	7.81	1.1	none
97-0628	8s11e	50-60	obsidian	proximal	transverse	patterned	4-press flked	(12.68)	11.40	2.58	0.4	none
97-0664	8s11e	70-80	obsidian	distal	overshot	unpatterned	3-thinning	15.95	(10.74)	4.19	0.3	none
97-0692	8s11e	90-100	obsidian	complete	none	unpatterned	3-thinning	22.14	13.51	5.45	1.1	drill-like
97-0718	9n1e	0-10	obsidian	dis/prox	transverse	unpatterned	2-shaping	(14.38)	16.01	5.57	1.3	none
97-0753	9n1e	30-40	obsidian	complete	none	patterned	3-thinning	30.56	17.09	6.14	2.4	diamond-shp pt?
97-0799	9n1e	60-70	obsidian	unidentifiable	transverse	unpatterned	2-shaping	(8.64)	12.52	6.83	0.7	some bip reduct?
97-0813	9n1e	70-80	obsidian	unidentifiable	transverse	unpatterned	2-shaping	(8.89)	13.12	7.45	0.7	none
97-0845	9n1e	90-100	obsidian	complete	transverse	patterned	5-on flake	(41.38)	28.18	4.88	4.7	knife-like
97-0867	9n1e	110-120	ccs	dis/prox	transverse	unpatterned	2-shaping	(18.73)	27.21	6.69	3.6	none
97-0880	9n1e	120-130	ccs	dis/prox	transverse	unpatterned	2-shaping	(10.62)	14.47	5.31	0.8	none

97-0889	9n1e	130-140	obsidian	dis/prox	perverse	unpatterned	2-shaping	(18.10)	21.80	8.10	2.0	none
97-0922	21n3e	10-20	obsidian	midsection	transverse	unpatterned	2-shaping	(7.25)	8.97	3.82	0.2	none
97-0957	8s5e	10-20	obsidian	complete	none	unpatterned	2-shaping	14.56	9.95	4.97	0.6	none
97-0976	8s5e	20-30	obsidian	dis/prox	transverse	unpatterned	4-press flked	(17.17)	12.53	2.68	0.5	none
97-0989	8s5e	30-40	obsidian	unidentifiable	transverse	unpatterned	2-shaping	(15.11)	13.75	4.47	0.9	brkn/rewrked
97-1014	8s5e	50-60	obsidian	dis/prox	transverse	unpatterned	2-shaping	(22.26)	17.87	4.25	1.2	crtx present
97-1042	8s5e	80-90	obsidian	dis/prox	transverse	unpatterned	2-shaping	(14.90)	10.41	4.07	0.5	none
97-1077	8s5e	100-110	ccs	dis/prox	transverse	patterned	3-thinning	(24.04)	10.55	3.82	0.7	none
97-1108	8s5e	110-120	obsidian	complete	none	patterned	2-shaping	25.07	17.61	4.39	1.8	none
97-1109	8s5e	110-120	obsidian	dis/prox	transverse	unpatterned	2-shaping	(12.99)	11.01	3.26	0.4	none
97-1124	8s5e	120-130	obsidian	complete	none	patterned	2-shaping	28.74	13.80	5.01	1.8	none
97-1153	25s12e	0-10	obsidian	lateral	long.split	unpatterned	2-shaping	17.38	(9.85)	4.35	0.4	none
97-1154	25s12e	0-10	ccs	dis/prox	transverse	unpatterned	2-shaping	(12.55)	11.76	5.36	0.6	none
97-1220	25s12e	60-70	obsidian	unidentifiable	transverse	unpatterned	1-roughout	(10.49)	8.51	8.01	1.0	brkn w/ emod prsnt
97-1229	25s12e	70-80	obsidian	unidentifiable	transverse	unpatterned	2-shaping	(14.54)	7.39	5.29	0.3	none
97-1230	25s12e	70-80	obsidian	complete	none	patterned	2-shaping	22.78	14.69	7.03	1.7	none
97-1239	7n8e	0-10	obsidian	dis/prox	transverse	unpatterned	3-thinning	(13.73)	18.97	4.75	1.0	none
97-1240	7n8e	0-10	obsidian	complete	none	unpatterned	3-thinning	29.41	19.69	5.89	2.7	none
97-1275	7n8e	30-40	obsidian	distal	transverse	unpatterned	4-press flked	(5.24)	5.46	2.09	0.1	pt.tip?
97-1287	7n8e	40-50	obsidian	distal	transverse	patterned	3-thinning	(15.46)	10.17	3.01	0.3	crtx prsnt
97-1288	7n8e	40-50	obsidian	distal	transverse	unpatterned	3-thinning	(8.43)	5.95	2.18	0.1	pt. tip?
97-1330	7n8e	80-90	obsidian	distal	transverse	patterned	4-press flked	(25.72)	11.08	3.97	1.0	parallel flking
97-1371	8s8w	0-10	obsidian	distal	transverse	patterned	4-press flked	(11.45)	8.51	1.96	0.1	none
97-1411	8s8w	30-40	obsidian	distal	transverse	unpatterned	4-press flked	(13.49)	11.25	2.35	0.3	pt.tip?
97-1412	8s8w	30-40	obsidian	distal	transverse	patterned	3-thinning	(13.29)	12.00	3.08	0.3	pt.tip?
97-1427	8s8w	40-50	obsidian	dis/prox	transverse	unpatterned	1-roughout	(16.66)	9.18	5.21	0.7	none
97-1451	8s8w	60-70	obsidian	distal	transverse	unpatterned	4-press flked	(14.01)	7.92	2.62	0.1	pt.tip?
97-1479	8s8w	80-90	obsidian	dis/prox	perverse	patterned	4-press flked	(10.64)	13.45	4.15	0.4	none
97-1552	8s8w	130-140	obsidian	unidentifiable	transverse	unpatterned	2-shaping	(9.01)	7.44	3.95	0.3	none
97-1568	8s8w	140-150	ccs	dis/prox	transverse	unpatterned	2-shaping	(6.72)	12.18	3.46	0.3	none
97-1569	8s8w	140-150	obsidian	midsection	transverse	unpatterned	2-shaping	(11.23)	14.19	5.24	1.0	brkn, bip flking
97-1589	8s8w	150-160	obsidian	complete	transverse	unpatterned	2-shaping	(25.04)	15.06	6.90	1.9	crtx prsnt
97-1652	9n14w	10-20	obsidian	dis/prox	transverse	unpatterned	2-shaping	(12.75)	11.66	3.93	0.5	pt.tip?
97-1653	9n14w	10-20	obsidian	dis/prox	transverse	unpatterned	2-shaping	(6.97)	11.42	2.53	0.1	pt.tip?
97-1697	9n14w	40-50	obsidian	complete	none	unpatterned	2-shaping	22.98	13.07	5.54	1.4	none
97-1711	9n14w	50-60	obsidian	dis/prox	transverse	unpatterned	3-thinning	(4.86)	10.32	2.29	0.1	pt.tip?
97-1741	9n14w	70-80	obsidian	distal	transverse	patterned	4-press flked	(19.61)	7.65	2.25	0.2	pt.tip?,serrated
97-1742	9n14w	70-80	obsidian	dis/prox	transverse	unpatterned	1-roughout	(11.10)	14.25	7.48	1.2	none
97-1790	9n14w	100-110	obsidian	dis/prox	transverse	patterned	2-shaping	(20.10)	12.82	6.22	1.4	parallel flking
97-1791	9n14w	100-110	obsidian	complete	none	unpatterned	1-roughout	21.28	16.31	8.20	2.4	none
97-1792	9n14w	100-110	ccs	dis/prox	transverse	patterned	2-shaping	(25.00)	10.24	7.82	1.4	parallel flking
97-1819	17s12e	0-10	obsidian	complete	none	unpatterned	1-roughout	24.00	18.21	8.06	3.4	crtx present
97-1853	17s12e	20-30	obsidian	dis/prox	transverse	unpatterned	3-thinning	(15.95)	16.26	3.80	1.0	none
97-1877	17s12e	40-50	obsidian	complete	none	unpatterned	5-on flake	21.40	14.94	5.29	1.5	none

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( ) = extant measurements

dis = distal
prox = proximal
long.split = longitudinal split

CA-Sha-1544
Middle Mule Pond

Metric Statistics
Projectile Points

Cat.#	ML/mm	AL/mm	MW/mm	TH/mm	WT/gm	BW/mm	NW/mm	PSA	DSA	NOA	TYPE
97-											
-0009	(22.0)	(21.0)	22.0	4.0	1.5	(11.0)	9.0	(110)	120	(010)	CN
-0011	15.0	15.0	11.0	3.0	0.5	1.0	4.0	050	145	095	G
-0012	(18.0)	(18.0)	13.0	3.0	0.5	00.0	00.0	000	(135)	000	G
-0019	22.0	22.0	16.0	4.0	0.8	2.0	5.0	070	150	080	G
-0020	22.0	22.0	(16.0)	4.0	0.9	11.0	7.0	170	145	025	SN
-0022	21.0	20.0	11.0	4.0	0.7	11.0	7.0	170	200	030	SN
-0026	(25.0)	25.0	(19.0)	4.0	1.3	3.0	6.0	070	140	070	G
-0027	(22.0)	(22.0)	(17.0)	4.0	1.2	3.0	7.0	060	145	085	G
-0028	24.0	24.0	13.0	4.0	1.0	13.0	9.0	180	180	000	SN
-0029	(24.0)	(24.0)	14.0	3.0	0.8	2.0	4.0	065	140	075	G
-0030	(22.0)	(21.0)	15.0	3.0	0.8	1.0	5.0	060	145	085	G
-0031	(21.0)	(18.0)	(22.0)	5.0	1.6	00.0	(8.0)	000	150	000	G
-0032	25.0	25.0	15.0	5.0	1.2	15.0	11.0	130	(250)	(120)	CT
-0033	23.0	23.0	17.0	4.0	1.4	(12.0)	10.0	140	160	020	CN
-0035	00.0	00.0	(15.0)	3.0	0.4	2.0	3.0	050	135	085	G
-0037	(12.0)	(12.0)	(13.0)	2.0	0.4	3.0	5.0	070	155	085	G
-0038	(19.0)	(19.0)	11.0	3.0	0.8	1.0	5.0	050	155	095	G
-0039	18.0	18.0	14.0	3.0	0.5	2.0	3.0	065	145	080	G
-0082	00.0	00.0	00.0	(3.0)	0.4	3.0	5.0	075	140	065	G
-0088	19.0	19.0	(15.0)	4.0	0.7	2.0	6.0	070	130	060	G
-0089	16.0	16.0	10.0	2.0	0.4	8.0	7.0	120	210	090	CN
-0102	16.0	14.0	10.0	3.0	0.4	10.0	00.0	000	150	150	CT
-0106	(17.0)	(17.0)	18.0	5.0	1.0	00.0	5.0	000	140	000	G
-0111	21.0	21.0	17.0	3.0	0.5	00.0	4.0	070	140	070	G
-0112	19.0	19.0	14.0	3.0	0.4	2.0	5.0	070	140	070	G
-0113	19.0	17.0	16.0	4.0	0.7	12.0	10.0	110	220	110	CN
-0114	00.0	00.0	15.0	3.0	0.6	2.0	4.0	070	110	040	G
-0116	00.0	00.0	(16.0)	3.0	0.4	1.0	5.0	070	130	060	G
-0137	24.0	23.0	17.0	3.0	0.6	3.0	5.0	080	125	045	G
-0138	20.0	(17.0)	(12.0)	2.0	0.3	00.0	4.0	000	120	000	G
-0144	(16.0)	(16.0)	(13.0)	3.0	0.6	1.0	4.0	070	160	090	G
-0148	25.0	25.0	17.0	6.0	1.8	13.0	9.0	150	150	000	CN
-0149	22.0	22.0	14.0	5.0	1.0	1.0	4.0	065	170	105	G
-0150	22.0	22.0	14.0	3.0	0.4	1.0	6.0	070	170	100	G
-0151	23.0	23.0	15.0	3.0	0.7	3.0	5.0	075	115	040	G
-0197	(17.0)	(17.0)	15.0	4.0	0.8	3.0	5.0	065	125	060	G
-0198	21.0	21.0	13.0	3.0	0.5	2.0	4.0	100	150	050	G
-0228	2.8	2.8	14.0	5.0	1.7	10.0	9.0	100	190	090	CN
-0229	27.0	27.0	20.0	5.0	1.5	4.0	8.0	065	130	065	G
-0234	29.0	(26.0)	18.0	4.0	0.9	3.0	4.0	000	130	000	G
-0259	17.0	17.0	12.0	2.0	0.3	3.0	4.0	055	130	075	G
-0260	26.0	24.0	(18.0)	5.0	1.5	18.0	9.0	180	190	010	SN
-0262	(20.0)	(18.0)	17.0	3.0	0.7	00.0	5.0	000	130	000	G
-0263	20.0	20.0	15.0	3.0	0.5	00.0	5.0	065	135	070	G

(continued)

-0264	18.0	17.0	16.0	4.0	0.6	00.0	5.0	000	135	000	G
-0265	(27.0)	(27.0)	20.0	6.0	2.7	17.0	12.0	120	170	050	CN
-0266	22.0	22.0	12.0	3.0	0.5	2.0	5.0	065	125	060	G
-0269	29.0	29.0	17.0	6.0	2.3	12.0	11.0	160	210	050	CN
-0270	(18.0)	(18.0)	13.0	3.0	0.4	00.0	5.0	070	130	060	G
-0271	(15.0)	(15.0)	10.0	5.0	0.6	2.0	5.0	070	175	105	G
-0272	16.0	16.0	(12.0)	3.0	0.4	1.0	5.0	065	130	065	G
-0277	24.0	24.0	14.0	5.0	1.6	10.0	9.0	120	190	070	CN
-0301	19.0	19.0	14.0	3.0	0.6	00.0	4.0	100	140	040	G
-0369	(21.0)	(21.0)	16.0	3.0	0.9	1.0	11.0	060	150	090	G
-0370	15.0	15.0	00.0	2.0	0.3	00.0	4.0	080	000	000	G
-0425	19.0	18.0	13.0	4.0	0.5	6.0	4.0	120	150	030	CN
-0441	23.0	23.0	18.0	4.0	1.3	00.0	8.0	075	160	085	G
-0466	(13.0)	(12.0)	12.0	4.0	0.7	12.0	9.0	135	210	075	CN
-0467	23.0	23.0	12.0	3.0	0.5	1.0	5.0	070	145	075	G
-0513	00.0	00.0	00.0	(10.0)	00.0	00.0	00.0	(130)	(200)	(070)	WS
-0516	00.0	00.0	00.0	7.0	7.6	00.0	00.0	000	000	105	WS
-0525	26.0	26.0	19.0	6.0	2.3	13.0	10.0	135	185	050	CN
-0601	(18.0)	(18.0)	14.0	3.0	0.7	00.0	4.0	070	140	070	G
-0629	28.0	28.0	14.0	4.0	1.1	14.0	7.0	180	190	010	SN
-0641	(23.0)	(21.0)	(14.0)	2.0	0.6	00.0	(5.0)	000	130	000	G
-0663	00.0	00.0	(15.0)	(5.0)	0.8	00.0	(11.0)	000	200	000	UNT
-0678	(19.0)	(19.0)	19.0	4.0	1.4	14.0	10.0	130	155	025	CN
-0679	(28.0)	(28.0)	19.0	5.0	2.3	7.0	8.0	075	120	045	G
-0691	(20.0)	(20.0)	(19.0)	5.0	1.5	13.0	9.0	120	130	010	CN
-0719	17.0	17.0	12.0	3.0	0.6	2.0	4.0	080	150	070	G
-0728	00.0	00.0	(14.0)	(3.0)	0.4	00.0	00.0	000	160	000	UNT
-0741	22.0	22.0	14.0	4.0	0.9	9.0	8.0	135	140	005	CN
-0742	00.0	00.0	00.0	00.0	0.6	00.0	00.0	000	000	095	UNT
-0768	32.0	32.0	15.0	8.0	2.9	13.0	10.0	120	220	080	CN
-0785	(17.0)	(17.0)	15.0	3.0	0.6	1.0	5.0	060	130	070	G
-0814	22.0	22.0	13.0	4.0	0.8	8.0	5.0	135	155	020	CN
-0822	30.0	30.0	19.0	5.0	1.9	10.0	9.0	100	140	040	CN
-0854	(21.0)	(21.0)	18.0	4.0	1.6	15.0	9.0	130	150	020	CN
-0855	00.0	00.0	11.0	4.0	0.6	(11.0)	7.0	150	240	090	CN
-0896	25.0	25.0	19.0	6.0	1.8	00.0	7.0	140	165	025	G
-0958	(22.0)	(22.0)	(12.0)	1.0	0.2	(12.0)	6.0	150	190	040	SN
-0999	19.0	19.0	14.0	4.0	0.5	4.0	5.0	090	140	050	G
-1062	30.0	30.0	16.0	8.0	2.5	6.0	9.0	080	225	145	SS
-1078	25.0	24.0	12.0	7.0	2.0	9.0	9.0	105	240	135	SS
-1156	(16.0)	(16.0)	12.0	2.0	0.4	2.0	4.0	080	140	060	G
-1157	14.0	14.0	13.0	3.0	0.3	1.0	5.0	070	165	095	G
-1158	15.0	15.0	12.0	3.0	0.4	3.0	4.0	070	150	080	G
-1159	17.0	16.0	12.0	2.0	0.3	3.0	2.0	085	130	045	G
-1160	(18.0)	(18.0)	(13.0)	4.0	1.0	00.0	9.0	160	195	035	SN
-1208	00.0	00.0	00.0	(4.0)	00.0	00.0	00.0	000	000	000	UNT
-1231	28.0	28.0	18.0	7.0	2.7	14.0	12.0	115	190	075	CN
-1257	(20.0)	(20.0)	15.0	3.0	0.6	6.0	5.0	075	150	075	G
-1276	20.0	20.0	(16.0)	3.0	0.7	5.0	6.0	070	130	060	G
-1331	20.0	18.0	17.0	4.0	1.2	15.0	11.0	160	180	020	SN
-1397	00.0	00.0	00.0	(2.0)	0.5	00.0	00.0	000	000	060	G
-1413	19.0	(19.0)	13.0	3.0	0.5	00.0	4.0	060	140	080	G
-1452	(20.0)	(20.0)	15.0	3.0	0.8	3.0	6.0	075	120	045	G
-1453	00.0	00.0	(11.0)	(3.0)	0.4	1.0	5.0	080	140	060	G

(continued)

-1519	00.0	00.0	00.0	(7.0)	1.3	00.0	00.0	000	000	(120)	UNT
-1520	26.0	26.0	17.0	3.0	0.9	00.0	5.0	060	125	065	G
-1553	17.0	17.0	10.0	4.0	0.6	8.0	7.0	160	240	080	SN
-1590	(22.0)	(22.0)	17.0	6.0	0.8	12.0	11.0	135	195	060	CN
-1605	23.0	23.0	15.0	6.0	1.8	14.0	8.0	150	190	040	CN
-1665	16.0	16.0	12.0	3.0	0.4	00.0	6.0	070	140	070	G
-1666	00.0	00.0	(15.0)	3.0	0.5	00.0	5.0	085	145	060	G
-1698	(13.0)	(13.0)	15.0	2.0	0.4	2.0	4.0	080	130	050	G
-1727	23.0	22.0	(15.0)	3.0	0.8	(13.0)	8.0	200	170	030	SN
-1754	00.0	00.0	00.0	9.0	4.7	00.0	00.0	000	000	000	WS
-1793	21.0	21.0	(13.0)	3.0	0.5	1.0	4.0	080	170	090	G
-1834	16.0	15.0	12.0	4.0	0.6	12.0	8.0	140	220	080	SN

KEY:

ML =Maxial Length
AL =Axial Length
MW =Maximum Width
TH =Thickness
WT =Weight
BW =Basal Width
NW =Neck Width
PSA =Proximal Shoulder Angle
DSA =Distal Shoulder Angle
NOA =Notch-Opening Angle
TYP =Projectile Point Type

G =Gunther Series
CT =Cottonwood Triangular
SN =Side-Notched
CN =Corner-Notched
WS =Wide-Stem
SS =Small-Stem
UNT =Untypable

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